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History of the Dairy Industry



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History of the Dairy Industry

By T. R. Pirtle

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History of the Dairy Industry

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Dedicated to
Father and Mother



Mr. and Mrs. W. H. Pirtle.

FOREWORD

One of the safest and best guides to follow in planning for the future in any industry is a knowledge of the history of that industry. From an economic standpoint and from the standpoint of business policies a picture of all the steps and factors that have influenced the industry should govern its future development. All this may safely be said of the history of dairying because the history of no other industry records so well the development of all science and industry and even of civilization itself.

The history of dairying extends beyond written record. The dairy cow and the product of her milk were evidently appreciated long before modern civilization. In this country, where dairy products play such an important part in the diet of its people, where the consumers pay between three and four billion dollars annually for milk, and products of milk, and where more than 25 million people are concerned with its production, manufacture, and distribution, the history of the industry in this country and elsewhere is of the greatest value.

In the long history of dairying mistakes have been made over and over again by those who have not known and heeded the lessons and experiences of previous generations. Knowledge of the past should be studied and used as a guide by our leaders in the industry. Although wonderful progress has been made in the science and practice of dairying, although invention and genius have transformed our industry into one of greater efficiency, and although great strides have been made in dairy sanitation yet all this progress only tends to open new fields and suggest greater possibilities of future development.

We are moving along rapidly in the science and art of dairying. The advance has been so rapid that apparently no one has heretofore attempted to collect and record the many steps that have influenced methods and practices. Now more than ever before the importance of the dairy industry in the health and prosperity of civilized nations is recognized. It seems, therefore, particularly opportune that the many events in the long progress of dairying have now been assembled for the use of the dairy industry by one who has given many years of study to this important subject.

DR. C. W. LARSON,

Chief, Bureau of Dairy Industry,

U. S. Department of Agriculture.

August 14, 1926.

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INTRODUCTION

The purpose of this book is to bring together the leading events of the dairy industry with a view to a broader understanding of its progress in all countries of the world and to give the reader a picture of the various countries—something of the people, the cattle, the soil, the grass and forage, climate and other factors favorable or unfavorable to dairying.

The literature of the industry has been the source of information, as very little personal information was obtainable, although a portion of the manuscript was vised by competent dairymen in some of the countries. All comparisons, and advertising have been avoided as much as possible. It is unfortunate that some of the history is not up-to-date but a knowledge of the deficiencies of the past may be an incentive for better records in the future.

It is presumed that the reader is fairly familiar with the details of dairying in general use, therefore, much of detail has been omitted. The brevity of the writing and the crowding of material into few pages has been intentional and apparently necessary to cover the subject.

The accomplishments of scientists has not been treated separately as it would simply mean a repetition of the whole subject of dairying as every part of the industry has been put on a scientific basis, methods have been improved and efficiency of machinery and equipment has been obtained while increasing the volume of business, perfecting sanitation, and making the operation more economic.

If the mistakes and successes of the past can be studied it is believed that there will be fewer mistakes and greater successes in the future.

ACKNOWLEDGMENTS

Much of this publication would have been impossible but for the help of personal friends and friends of the industry and I wish to specially thank them for their timely aid. While I have had this subject in mind for years it was really the encouragement of friends in the Bureau of Dairy Industry and Bureau of Agricul-

tural Economics caused me to make the decision to attempt the publication.

In the collecting and arranging the historical events much data have been gleaned from many authors in such a way that it was impossible to quote and give credit, however, the book is but a collection of dairy literature with an attempted historical arrangement. A great deal of the data, including ideas, arrangement, style, etc., have been taken from the following very valuable publications: Dairy Technology, Larsen and White, The Butter Industry, Hunziker, Condensed and Evaporated Milk, Hunziker, Feeds and Feeding, Henry and Morrison, Science and Practice of Buttermaking, McKay and Larsen, Feeds, C. W. Larson, Market Milk, Kelly and Clements, Cooperation in Denmark, C. L. Christensen, Cheese, W. W. Fiske, Food Products, Shanahan, History of Agriculture in the Northern States, Bidwell and Falconer, History of the Milk Trade, Dr. L. S. Dijkstra, The Dairy Industry, Whyte, Pedigree Cattle in Friesland, Blink, Dairying in China, C. O. Levine, Ancestry of Domestic Cattle, Morse, World's Dairy Congress Proceedings, and many government publications.

I wish to thank personally the following for assistance or material furnished: Dr. C. R. Corey, J. C. McDowell, C. E. Beardslee, Frank J. Holt, S. J. Van Kuren, Honorable J. A. Ruddick (Canada), G. J. Blink (Netherlands), Dennis Hegerty (Ireland), and Hon. S. Sorensen (Denmark).

It has been a pleasure to work with friends of dairying and their assistance, advice, material and pictures have been given so well that I feel that this publication is not a proper contribution for the services they have rendered.

September 1, 1926.

T. R. PIRTLE.

GENERAL OUTLINES OF DAIRYING.

Back into the night of history, when the orphan child waked and cried from hunger, a cow, outside was tied to a stake waiting to be milked.

ANCIENT DAIRYING—The written history of man does not reach back to the beginning of cattle nor is there a record of the date when cows' milk was first used, or when or how butter or cheese was first made. The story of the domestication of cattle has been stated by some authors but recent excavations of cities of the oldest known civilizations show clearly that cattle were common, well known, and highly appreciated at an earlier age; however, cattle, both wild and domesticated, have existed since our earliest written history. According to Lydekker there were cattle in all countries except Australia, New Zealand, and the Western Continent at a very early date; how they were distributed is not known.

Possibly one of the oldest buildings yet excavated was unearthed near Babylon by the British Museum and the University Museum of Philadelphia, U. S. A., and their report states that the building is more than 6,000 years old.

"Its facades were set back from the platform so as to leave a narrow strip on which stood a row of statues of bulls sculptured in the round. These stood some three feet high Of the frieze of cattle lying down we have a dozen examples. The most interesting, a panel four feet long, has on one side a milking scene, cows and their calves and men milking the cows into tall jars."¹

This is possibly the oldest record of the milking of cows. A peculiar thing is that the men were doing the milking, but for centuries after that period it was done by women.

The Egyptian civilization possibly dating from 4,000 B. C., left many records in pictures to indicate the use made of cattle in their day—methods of herding, breeding, and dairying were common with them. At that early age cattle were branded with hot irons for identification, before being driven to a common pasture in the spring.

¹ The jars were similar in shape to those now in England called 'churns,' and used to hold milk when brought from the farms.

Egypt had three kinds of cattle, namely, long horned, hornless, and humped (Zebu). Steers and oxen were killed for meat. In their pictures the first churning scene is found and butter is also shown in finished rolls which are similar to those made on farms even today.

It is hard to realize the great care, honor, and love these early people had for cattle and especially the milk cow and milk goat. In some countries these animals were actually worshiped and such veneration surely must be the result of some great service during a period of great need and, therefore, has been stamped into these nations, i. e., India, Egypt, Arabia, and Babylon.

In the Babylonian region excavations have uncovered the Nebuchadnezzar cylinder containing records of that early age. The cylinder, written about 2,000 B. C., has a few references to cattle, according to the Museum Journal, as follows:

"I fabricated large bulls of silver and I placed them on its threshold.
On the thresholds of their gates I placed huge bronze bulls. . . ."

A dairy scene is described as a part of the sculpture of one of the excavated buildings:

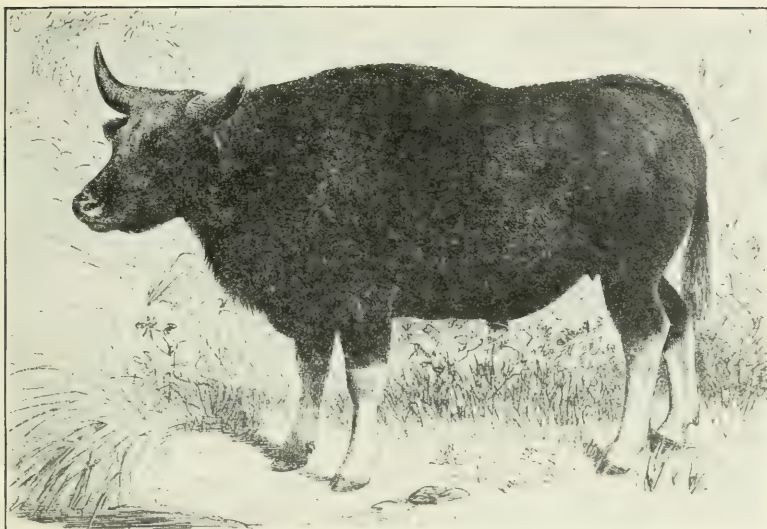
"Milk is poured from the pointed jar through a funnel or strainer of very modern aspect, into a flat-bottomed vessel resting on the ground. This latter vessel which has perhaps three or four small legs, tapers toward the narrow mouth. Milk, butter, and cheese and very many kinds of beverages, besides beer, wine, and oil of different brands and qualities, are mentioned in the earliest inventory list.

"In order to multiply the butter and the beverage . . . so that the serpent do not get away with the cream . . . the shepard takes his place near Ningirsu under his order. . . ."

"The milk goat is called 'Mother of the god Ningirsu. . . the cow is called 'Mother of the moon.'"

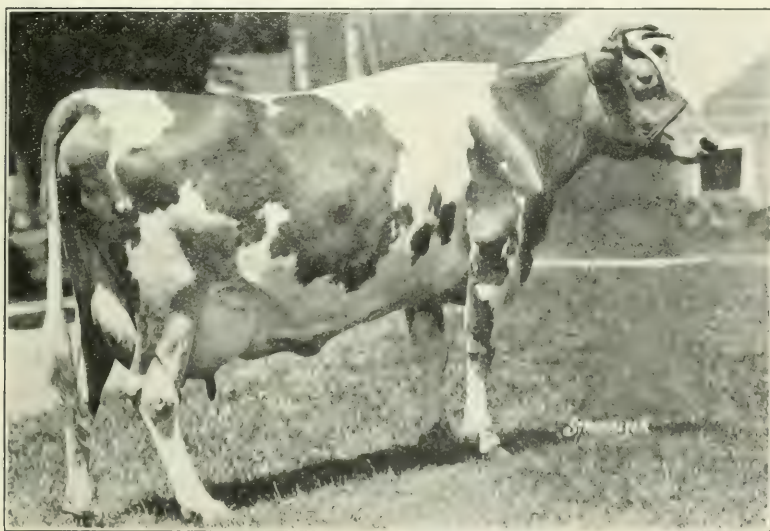
"The Sumerian of Tell El Obeid is the peaceful farmer concerned with his tame cattle."

Other than Biblical writings the oldest is the Vedic hymns of India, written about two or three thousand years B. C. These hymns are a collection of folklore stories handed down from unknown centuries and reflect the home life and occupation of the Hindu people of prehistoric times. In these Vedic hymns the cow was proclaimed as a great benefactor of the race. They further indicate that milk was drunk, butter was made, and that it was considered a sin to kill a cow for meat. Nothing in these early writ-



Represents the Oldest Known Type of Cattle.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.



Improved Type of Dairy Cow.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

ings, however, indicate when cattle were domesticated; in fact, each of the stories speak of the handling of cattle in a familiar way as we do today. The butter was changed into ghee, but cream appears not to have been separated before being churned.

About 2,000 years B. C. the Greeks had herds and flocks but it is said that the milk of cows and sheep was not used extensively, although it was very common. Almost contradictory to that statement is the claim that "Neither milk nor cheese failed in Libya the year round."

In the eastern countries of Europe cows and milk mares were kept while at the same time northern Europe maintained great herds of wild cattle. According to Herodotus (500 B. C.) the Scythians or Tartars used mares' milk for buttermaking and Aristotle writes about casein, fat, and water, as all the substances in milk as then known.

In Italy sheep and goats were quite plentiful and were used for milk production in preference to cows.

Gibbon¹ gives some real pictures of the conditions existing about 225 B. C., as follows:

"The agricultural laborer and the artisan in Spain, Gaul, Britain, Syria, and Egypt maintained himself as in the present (1780) by his own labor and that of his household without possessing a single slave."

Europe was being overrun in the first centuries of the Christian era by many barbarian tribes, each tribe taking their cattle with them for meat and dairy products on their invasions.

Gibbon says the Tartars (376 A. D.) took herds with them on their campaigns for milk and meat supply, and that there were few places where the cattle could not find some tolerable pasture. The Tartars with houses on wagons moved from one forage to another between China and Germany, with 20 to 30 oxen to each wagon.

The extent of the holdings of cattle may be conjectured from another statement of Gibbon:

"A freedman, under the reign of Augustus, though his fortune had suffered great losses in the civil wars, left behind him 3,600 yoke of oxen, 250,000 head of smaller cattle (sheep and goats) and what was almost included in the description of cattle, 4,116 slaves."

¹ The Decline and Fall of the Roman Empire, Edward Gibbon.

MEDIEVAL DAIRYING — During the first century there was an appreciable spirit of improvement spread over Europe. There was a copying of the best methods of industry of the most civilized countries. This was partly a result of the increase in commerce which was more open and profitable than previously. The use of tame grasses was introduced into Italy, lucerne (alfalfa) being specially mentioned. These grasses gave assurance of winter feed and thereby encouraged the keeping of flocks and herds which in turn helped to enrich the soil to the benefit of agriculture. In Caesar's time monstrous herds of cattle covered a large part of Europe, but it is well to note that the "care of the house and family, the management of the land and cattle were delegated to the old and infirm, to women and slaves." The Roman Empire was built on the labor of slaves.

Possibly the greatest advance of the first centuries (of the Christian Era) was the beginning, looking to the establishment of stable governments under which land and property, including cattle, could be kept by free men.

Milk and dairy products were marketed in cities, and severe punishment was meted out to anyone convicted of adulterating milk. In cities the cows were driven from house to house and the milk drawn as sold. Cheese stores were mentioned at that time. Local markets, where the producer and the consumer could meet and trade, were popular.

When Marco Polo traveled over a large portion of Asia, about the middle of the 13th century, he found dairy products and "cattle of every kind, well-sized, fat and exceedingly handsome." He mentions kumiss and says it was intoxicating to a certain degree. He described the yak, which was then as now a dairy and draft animal.

Gunpowder was invented about the middle of the 14th century and was a considerable benefit in the advancement of dairying and livestock raising. By its use the wild animals, especially those used for food, were exterminated very rapidly and domestic animals had to be raised to supplement the depleted meat supply. The predatory animals also were killed thus helping the farmers to save the stock usually destroyed by them and thereby increased his herds.

The methods of government and land tenures had much to do with the encouragement of dairying and agriculture. The feudal system, which existed in most of Europe for a long time, together with the vassals and serfs, was able to help dairying only in a small way. The depression of morale and low standards of living of the serfs unfitted them to respond to the spirit of the age or the opportunity to improve their cattle and dairy products. It is true that some of the wealthy lords accomplished some excellent results in dairying during this period.

During the Middle Ages sheep and goats were very prominent, stables and dairies with crude utensils were in use, but in some places the cattle were kept in the houses, and often only partly separated from the living quarters.

Some countries adopted standard measures about 1546, which included the barrel and ton and fractions of each. Cheese markets were found in the large cities.

India produced a great quantity of dairy products in the 15th century and it is said that the people and even the palace elephants, of which there were hundreds, had a diet largely of "rice and butter," or "milk and vegetables," or "meat, rice, fresh milk and cheese."

PREPARATORY PERIOD, 1600 TO 1880—From the 16th to the 19th century there was much progress in dairying, in farming methods, cattle raising, in breeding and in the manufacture and use of milk and its products. Numerous breeds of cattle were founded in England, France and The Netherlands, while in many countries some cattle had been bred pure for years but breeds were not clearly defined. London and Paris had milk delivered regularly each day, but usually in open vessels.

During this period especially the selection of cows for milk production went forward in most of the countries.

Red clover was introduced into Great Britain in 1645 and a writer of that day says the farmers received more benefit from red clover than from all the books written on agriculture.

According to Bijkstra (Milk Dealer, October, 1918), Dr. Wellman asserted in 1670 that the healthy rural population was indebted to sheep milk and fresh air for their strength. He also recommended milk for pale, "scrophulosis" people (tuberculosis).

Many tests were used for milk and cream, some of which were almost foolish, and little or no knowledge was gained from them. In 1700 Leenewenhoek, of The Netherlands, discovered bacteria but the subject was not further developed until 1838 when Ehrenburg and Muller began a study of them.

The standards for cows in England in 1758 were as follows:

"A cow giving three gallons (imperial) at a time was considered a very fine cow, 2 gallons at a time was a fine cow, and 5 quarts the lowest worth keeping." (Sir Thomas Hale.)

About the year 1800 Great Britain began using bone meal for fertilizer and science, which had recently discovered several new elements, took on new life.

The settlements of America were made principally in the period between 1600 and 1700 and while no special advance in dairying was made, still the foundation of the industry was laid by the introduction of cattle of various breeds.

The value of fertilizer and the advantage of the rotation of crops were stressed while fodder, roots, roughage, and tame grasses were being used in the feeding of dairy cattle.

Steam power was discovered and perfected until it was practicable, and its use in transportation on land and sea was of great importance in acquiring and supplying desirable markets (1840-1850).

In America the development of farm machinery after the year 1800 made it possible to bring millions of acres of new land under cultivation and thereby rapidly increased surpluses of grain which sought a market principally in Europe. European agriculture could not readily adjust itself to this competition.

An increase in dairying followed closely each advance in agriculture.

The production of milk, butter, and cheese by 1850 had become greater in America than in any other country and exports of cheese continued to increase up to 1882.

THE GREAT DEVELOPMENT—The great movements of grain and meat products from the new lands of America into the markets of Europe during the decade from 1875 to 1885 caused a partial loss of these markets to the European countries that formerly supplied them, seriously affecting England, Ireland, Den-

mark, and The Netherlands. The competition in the production of grains and meats was so great that each of those countries revised its methods of agriculture; Denmark went into dairying as a primary occupation, while England, Ireland, and The Netherlands improved their dairy methods and turned more to cooperative dairying to enable the farmers to remain on their farms. Other countries were also affected.

American cities grew and open markets were established in the large cities, especially along the Atlantic coast. Railroads were built with rapidity, connecting all parts of the country. Mechanical refrigeration was introduced commercially and was used on ocean steamers to preserve perishable products while refrigerator cars on the railroads carried all classes of dairy products with but slight deterioration. Refrigeration greatly extended the life of the dairy products and hence multiplied their possible markets many times.

The making of butter and cheese on farms began to give way to factory manufacture and soon, during the period from 1860 to 1885, the "factory system" was introduced throughout the world. This system was very economical in the manufacture of dairy products and it also removed much work from the farms. It made possible a great increase of products without an increase of labor. From that date, 1880, dairying is seen to make its greatest growth in quantity of products made and exported.

Science found dairying almost a new field and rendered much aid in the development of methods and in giving information as to the true character of milk and its products, as well as in the formulation of practices for care of the products and the sterilizing of dairy utensils, giving reasons and results. Science also helps to establish the food value of milk and manufactured dairy products. Scientific investigations of feeds and feeding have added much knowledge as to the requirements of the dairy cow when producing milk.

As the demand for more and better products increased, the dairy industry called for more and better machinery and equipment to handle larger quantities of milk and its products and to make improved products to meet the requirements as education and ideals advanced.

The inventors supplied many thousands of mechanical devices

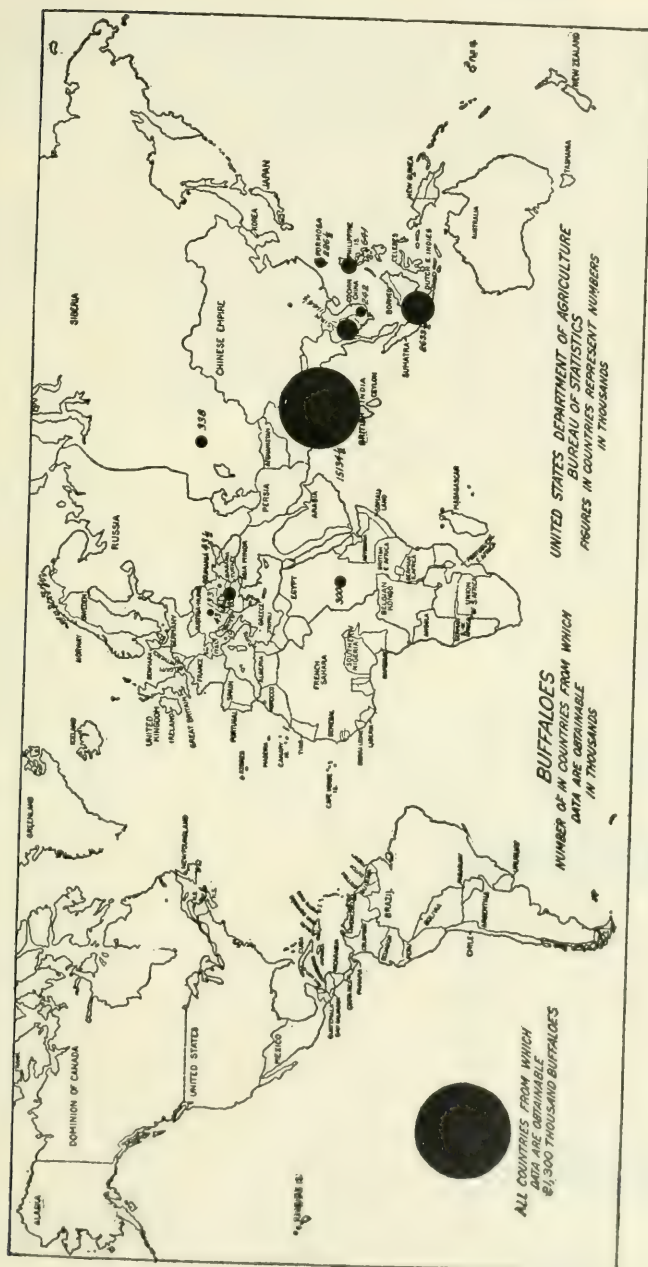
of all kinds, including the combined churn and butter worker, cream separator, pasteurizer, homogenizer, sterilizer, bottle washer, butter cutter, condensing pan, milking machines, Babcock tester, together with many smaller pieces of equipment.

The development of dairying has also included the cow. Efforts have been made for many, many years to increase the yield of milk of cows. When the Babcock and Gerber cream testers had been invented and brought into use it then became possible to measure by these testers the quantity of fat in the milk of each cow of the herd, and by culling the low-producing cows from the herd the better cows could be retained and by breeding the better cows only the herds could be steadily improved. The cow-testing associations were made possible by the inventions of cream testers and the association is used in many countries to increase the quantity and improve the quality of milk produced. These associations in connection with the improved methods of feeding and the use of proved sires of the purebred dairy breeds has produced very high yields of milk in the principal dairy breeds, i. e., as high as 37,000 pounds of milk in a year from a cow. The herdbooks of the various countries have furnished standards of pure blood for the more prominent dairy breeds upon which more permanent improvement has been made.

At the present time the cooperative associations, the dairy press, the industrial associations, the dairy schools and colleges and experimental stations of the United States and similar organizations in other countries are furthering the dairy industry in every way possible, while the health authorities of all countries proclaim that milk and its products are necessary for the maintenance of the human race.

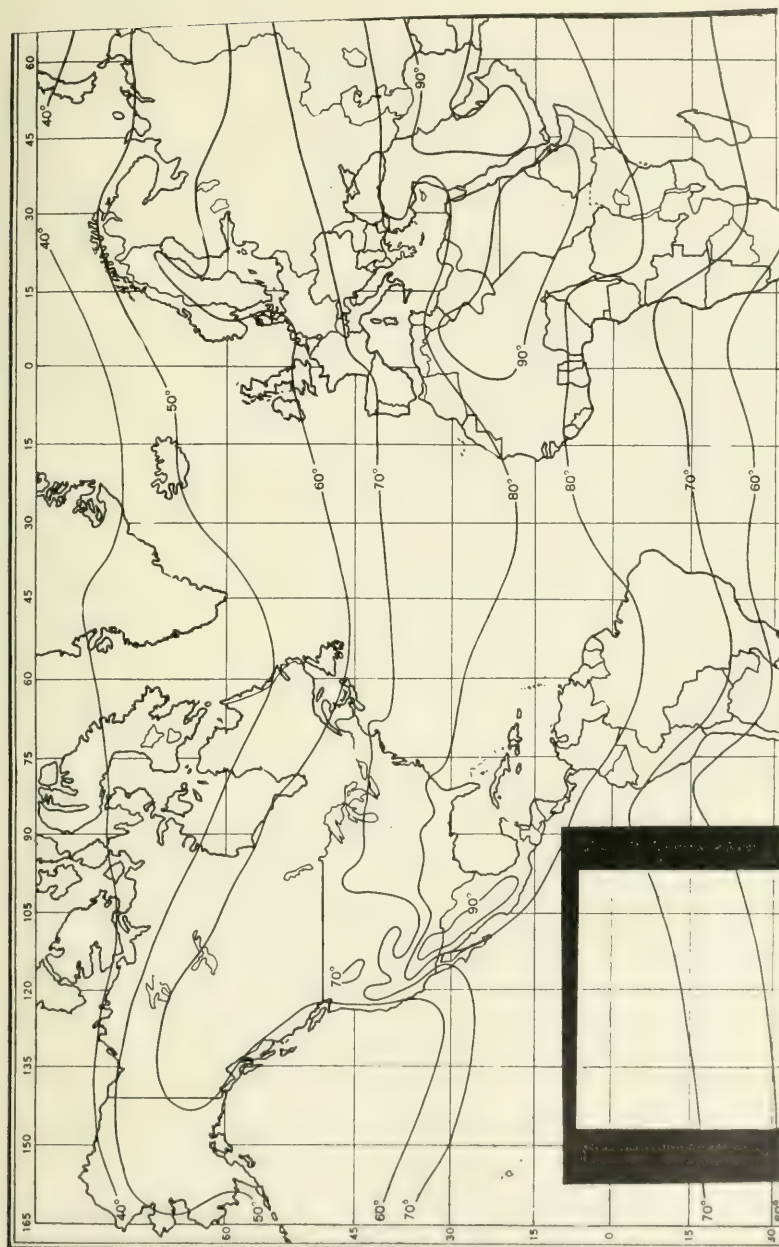
The trend of the industry is toward organization, and federation, for production and distribution of milk and its products while specialized operators of factories and scientists and dairy leaders are directing the dairy industry of the world in operation, research and efficiency.

The extent of dairying in the world is beyond the imagination even. More than 500 million cattle are in the world and at least 100 million are cows used for milk production. After feeding the people in the home countries there is still to be shipped for international trade more than 700 million pounds of butter a year, 700



Distribution of Buffaloes of the World.
Courtesy of U. S. Dept. of Agric.

million pounds of cheese, and about 500 million pounds of condensed milk, while there are other millions of pounds of milk chocolate, milk sugar, casein, and other milk products of immense quantities and great value passing from country to country to maintain the food supply.



Mean Average Temperature in July (Fahrenheit).
Courtesy of H. C. Pearce.

FIRST CHAPTER

UNITED STATES AND CANADA

UNITED STATES

CATTLE—INTRODUCTION AND EXTENSION—When cattle were introduced into the present territory of the United States there were no breeds; hence to follow the introduction and extension of cattle through the early period of this country is important, as it indicated the kind of cattle that were distributed over the various sections of the country, the methods of handling and feeding as well as the possibility of using the early cattle in the dairy industry. It is hard to conceive the great volume of nondescript cattle that were in existence before the beginning of improvement by breeding and selection.

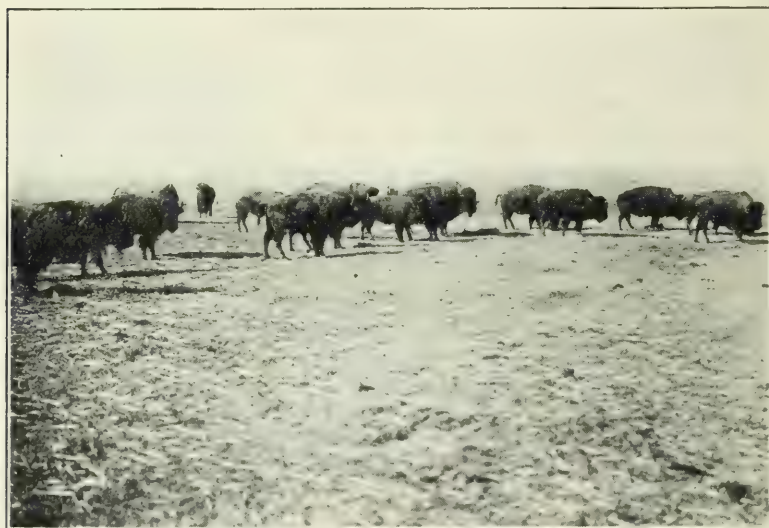
The importations of cattle into the United States began fully 100 years before the great improvement in breeds started in England. That improvement was first demonstrated with beef cattle and later applied to dairy cattle. The initial period of the English improvement was from 1760 to 1837, during which time the British breeders applied the art of selection to their breeding and established the breeds that have since become famous. These breeds have been carried to all parts of the world and practically have transformed the beef and dairy industries.

The sequence of events in the development of dairying has been similar in most countries, except as to length of time it takes to pass from one era to another. It took many centuries in Europe and Asia for cattle to become planted or distributed over the various countries, usually followed by a general mixing of cattle, and finally the development of breeds and standards among breeds. This process took less than 200 years in the United States as against 2,000 years in the Eastern Hemisphere although most of the progress was made in the last 50 to 75 years.

The first 100 years after the discovery of America was lost so far as planting livestock in the western continent was concerned, for while Columbus may have brought some cattle to Cuba or South America on one of his later trips, it is practically certain that

none of his animals were brought to the present boundaries of the United States. Another date is uncertain, and that is the time cattle were first brought to Mexico and driven north into California and Texas, but it is known that there were cattle in the southwestern portion of the United States "at an early date." (1825). De Soto is supposed to have left cattle and horses when his ill-fated expedition was abandoned, and Coronado took cattle with him on his expedition as far as Kansas and turned some loose on the plains. This would account for cattle after the death of De Soto in the southern section of the country and also on the plains.

COLONIAL CATTLE—Beginning with the colonization of America the records of cattle importations become more definite and accurate. At first the settlements had a great lack of cattle. Europe was the only source, for the Indians had no domestic animals, ex-



American Bison (Buffalo) on 101 Ranch.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

cept their dogs. Cattle were much needed to supply oxen, meat, milk, butter, and cheese for the settler's family on the frontier.

The colony at Jamestown, Va., imported its first cattle in May, 1611, and "at Christmas time 1618 there were but 300 in the colony." (Stith). Some of the Virginia stock were the black cattle of Spain, but a part of the stock came from England.

The Plymouth colony existed for three years without cattle, but in 1624 the "good ship Charity" landed one bull and three cows. These cattle are said to have been shipped from Devonshire, England, and possibly were Devon cattle.

The Dutch settlers on Manhattan (New York) brought with them, in 1625, 103 head of livestock, including bulls and cows. It is thought that these cattle were from the Isle of Trexel, near the coast of Holland and therefore probably were the Black and White (Friesian).



Herd of Holsteins.

Courtesy of the Dairy Farmer, Des Moines, Iowa.

The Massachusetts Bay colony bought 30 head the first year and other stock was sent them in 1630 and 1633. At the present site of Portland, Me., there were 57 head of cattle in 1648.

Delaware brought cattle in 1647 from Sweden; New Hampshire cattle were from the "large yellow" Danish cattle.

Pennsylvania purchased most of her cattle from the Swedes on the Delaware but the cattle had been mixed with the Netherlands cattle and also with the New England cattle.

Thus it is plain that by 1650 the country was well supplied for the raising of livestock and dairying. However, the types of cattle are significant, as they had been imported from Sweden.

Spain, England, Netherlands, and Denmark and it is further stated by writers of that period that the cattle were soon mixed until the characteristics were not traceable. It is also stated that all cattle decreased in size in a few generations.

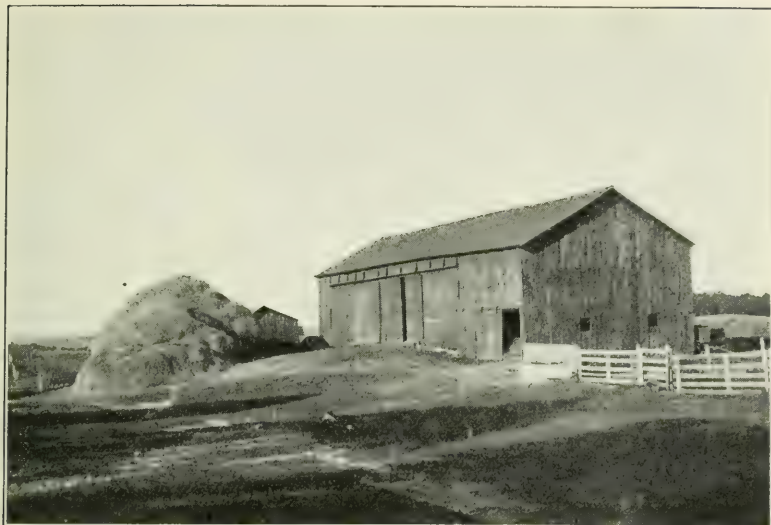
DISTRIBUTION—The importations of cattle did not stop after the introduction but have continued to the present time. The early Colonists had trouble rearing cattle as labor was very, very scarce and they had neither time nor help to build barns and provide proper feed for the winter months. This, of course, was before even the scythe was in general use. To cut grass with a cycle for a herd of cattle was an enormous task and the cattle generally became very poor before spring, many of them dying of starvation.

It is difficult to ascertain the increase in numbers of cattle in the Colonies but it must have been rapid as the records show that by the middle of the 17th century (1650) the New England Colonies had ceased to import butter and cheese from the home-lands and were exporting cattle, butter, and cheese. Some of the farmers sowed grain for the cattle but it was hard work to plant many acres with the implements of that time. There were 30 plows in Massachusetts Bay Colony in 1636.

The first New York butter-market news is given in the statement: "New England was early selling butter to New Netherlands."

Massachusetts Bay Colony was exporting butter and cheese in 1650, while the Connecticut Colony, according to Winthrop, was exporting butter and other provisions in 1660. By 1660 there must have been a large number of cattle in the country, as the records show that many thousand "neate beaste and hogge" were slaughtered each year for export.

At that early day, it is stated, that when there was a profit in the export of meat, butter, and cheese the farmers cleared more land and increased their stock of cattle that a surplus could be spared for export. It was difficult to open new lands, as the Atlantic seaboard was covered with timber and the open land previously used by the Indians for corn was acquired for the same purpose. The heavy work of clearing heavy timber made the extension of farm land slow and the increase of herds was also retarded by the lack of good pastures in the timber country. The timber lands



Old and Insanitary Barn. Still Too Many in the Country.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

were poorly grassed while the open land was needed for corn and tobacco. The open lands along the rivers and in the swamps produced grass but it made poor feed for cattle.



Sanitary Barn Under Horse Barn, Battle Creek, Mich.

Courtesy of Bureau of Agric. Economics, U' S Dept of Agric.

The settlers gradually pushed back into the interior, taking their cattle with them; in fact, many times the movement to the frontier was for the purpose of having more room for the herd. The Hartford colony was settled by pioneers moving out to get more room for their cattle. About the middle of the 17th century the Connecticut River Valley had developed a large cattle industry. New Hampshire and Vermont drove large herds of cattle to markets near Boston. These cattle were sold to feeders or dairymen.

A market space was set aside in 1656 in New York, and a similar one was established in Philadelphia at an early date. These markets helped to develop the dairy industry.

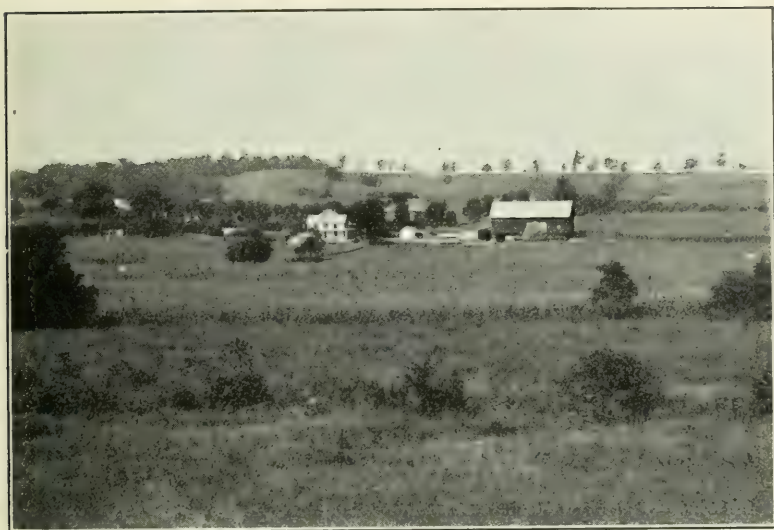


Interior View of Barn.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

Early in the 18th century the Shenandoah Valley was settled and the cattle raising in that section was important because of the number of cattle. Other settlements were made about 1772, on the Monongahela River Valley, where herds of from 200 to 400 were common. These settlements spread southward but after the invention of the cotton gin, in 1792, the South turned to cotton.

During the 100 years ended about 1763 the settlers had been in almost constant conflict with the Indians but had succeeded in clearing a strip of land about 100 miles wide along the Atlantic coast. After the Treaty of Paris, 1763, which removed the menace



Valley of Virginia, Stephens City, Va.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

of the Indians, there was a movement of pioneers to the new lands west of the Appalachian Mountains. By the year 1812 practically all the New England land had been taken and the settlers poured into the Ohio Valley. The soil of the eastern farms had been worked for the best part of 100 years and was losing its fertility, causing a great decline in the yield of the crops by 1750.

About that time great tracts of western land was thrown open for settlement and were soon settled.

By the year 1748 the pastures of Pennsylvania and New Jersey were becoming exhausted on account of the increase in number of cattle. The hay of the salt marshes was not sufficient to maintain the cattle. The German settlers in 1750 began to irrigate their pasturelands and irrigation was general by the end of the century.

The first cattle taken across the mountains from Virginia, about 1795, were owned by the Patton family and while the animals were mostly large they were of no definite breed. These cattle spread over Ohio.

The first purebred Shorthorn cattle imported into Kentucky was in 1817, but it was not until 1834 that the Ohio Company was organized for the purpose of importing English cattle; there-



Polled Shorthorn Bull.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

fore, it may be said that the improvement of cattle in Ohio and Kentucky was begun about 1840.

About 1820 colonists from the east began to settle in Texas around the city of Austin, and were generally engaged in cattle raising. Texas began to furnish cattle to the eastern markets in 1842, and in 1848 cattle were being driven from Texas to Ohio, where they were finished and sent on to market.

Each farmstead had its milk cows, generally from three to five.

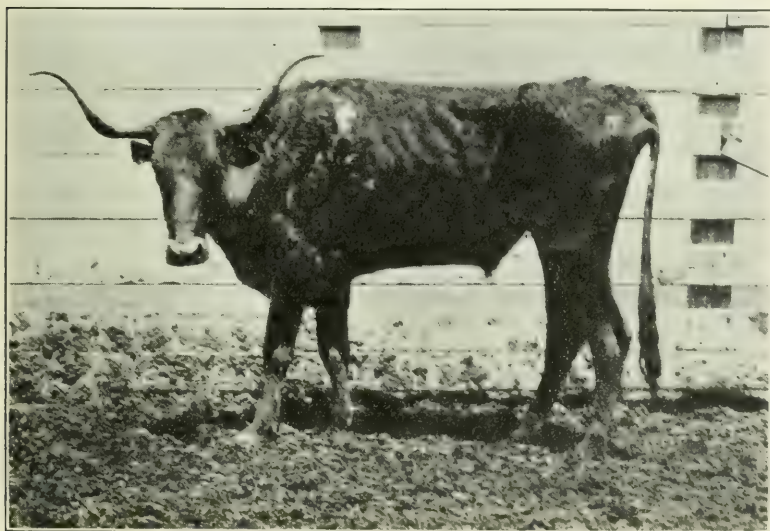
Illinois did not begin to raise cattle until about 1850, but long before that time Missouri and Iowa were furnishing feeder cattle to Ohio.

The regions of most numerous cattle during that early period became at a later period equally important as dairy centers.

When the railroads came into general use during the 50's they soon stopped the driving of cattle from the West and South to the East and with cheaper transportation the New England farmers lost much of their advantage in nearness to the great markets. Cattle were not driven part way for fattening, as previously, but were shipped direct to the eastern markets ready for the butcher. This caused a readjustment of the eastern farming and the beginning of specialized dairying in the North Atlantic States as well

as in New England. After 1850 the New England farmers turned still more to dairying, and the production of milk for the great cities was one of their greatest activities. The increasing market for milk in the great cities gave an additional incentive for greater milk production and the development of a type of cattle suited to that part of the industry.

In the Southern States, on account of tick fever, there were not fat cattle enough nor of dairy products manufactured for the domestic consumption within the States.



Texas Longhorn.

On the Great Plains of the West cattle raising was the principal industry from 1870 to 1885 and that section of the country was stocked with millions of cattle of a nondescript character altogether unsuited for any kind of dairy use. Texas was the chief source and its "longhorns" have been noted ever since, but not for beef or dairy products; in fact, the hide was often the item of greatest value.

Utah, Oregon, and other Western States had been stocked with common or scrub cattle. California received its cattle from Mexico and the industry, both beef and dairy, were not greatly stimulated until after the discovery of gold in 1848-49, when the great rush of people into the State created a great demand for these products.

During the years from 1880 to 1890 the Dakotas, Montana, and other Mountain States, became covered with cattle of all kinds but they were mostly beef cattle.

The introduction of cattle into the United States and the scattering of them over its entire surface took from 1611 to about 1880. It appears that at the end of that period cattle had spread all over the land, and during most of that time they had answered three purposes—the furnishing of beef, of milk, and oxen. Dairy products were made everywhere by the usual pioneer methods.

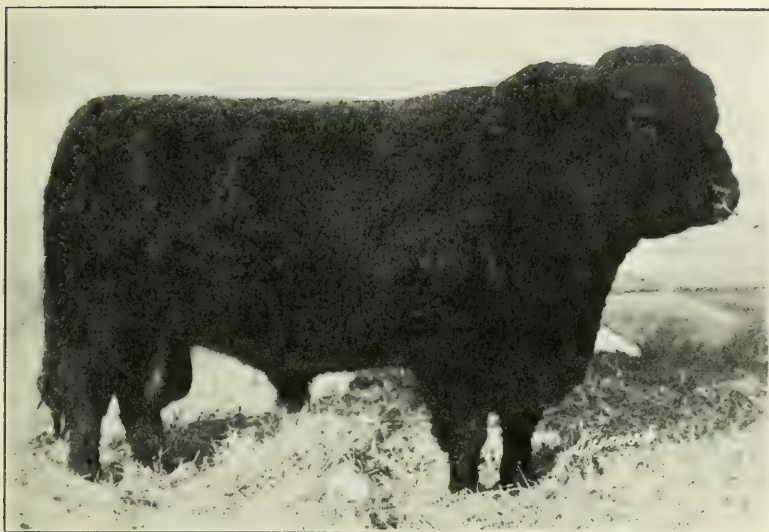


Farm House and Family of W. H. Pirtle.

The problem of developing the millions of inferior cattle in the country into dairy stock which would be profitable was given the dairy industry about 1850. The breeders of dairy cattle and leaders of the industry have accomplished a great deal by the organization of breeders' societies, purebred cattle clubs, bull associations, and cow-testing associations, but much remains to be done to increase the average milk production.

Cattle—**CARE AND DEVELOPMENT**—There were no distinct breeds of cattle in the colonial period, but some of them were better suited for beef than for milk, and others, such as the Black and White, in New Netherlands, and the Danish cattle in New

¹ Bidwell and Falconer, *History of Agriculture of Northern States*.



Galloway Bull.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

Hampshire, were more or less adapted to the production of milk. As early as 1664 the Connecticut Colony required cattle to be marked and all marks registered in the town books.

Improvement of cattle in New England was attempted in 1639, when various towns were required to keep a bull which was sometimes selected by a special committee.

There is a general acclaim of the improper care of cattle by the Colonists all along the coast. This was partly due to the lack of shelter which in turn was often due to the lack of help to erect barns. Some pretended to think it would make the cattle sick to be kept in barns. Coleman in speaking of the care of cattle says:

"Even the milk cows, who pay for their keeping in the most honorable manner, and whom the farmer should as little think of stinting and half-starving as he would his children, since without them, he could not raise his children, are treated with severity which admits no apology; and which is as inconsistent with the farmer's true interests as with the dictates of common justice and mercy."

The selection of feed for the cattle was a hard matter, as the timber country did not possess the grass which was so abundant in the western country; however, a few farmers planted peas or rye and oats for their cattle, and later straw, roots, potatoes, and grains were added in small quantities in winter.

Corn fodder is recorded perhaps for the first time by Governor Winthrop in his description of maize (corn), as follows: "The corn stalk when cut before it becomes dry makes a good feed for the cattle, although it is left lying on the ground."

The pampered Dutch cattle are said to have required more care than the New England cattle; also, milk cows were much less trouble than they were in Holland, as most of the time, if any care is required it is only for the purpose of giving them a little hay. It is further stated that the New England breed is not so large as the Dutch and do not give so much milk, but "fat and tallow well."

When Massachusetts was frontier early in the 17th century the cattle of the villages were cared for by a cowherd who went through the streets each morning sounding his horn and gathering his charges and returning them the same evening.

By 1790 the records show that cattle were kept on all farms, and a typical Massachusetts farm had 1 or 2 horses, 1 or 2 yoke of oxen, 15 head of cattle, including 5 milk cows.

The breeding of cattle up to the year 1800 showed little improvement, for from lack of selection, feeding, and breeding the cattle has actually decreased in size, and milking qualities had also deteriorated. The first generation decreased in size and the third and fourth generations were as small as the common native stock.

Cattle were housed in New York and New England during the winter, and the thrifty Germans of Pennsylvania gave their cows the best of care and housed them in large, well-built barns.

The cows calved in the spring and were allowed to go dry in the autumn or early in winter. Winter dairying, therefore, was not practiced to any extent. These conditions continued until about the middle of the 19th century, that is, 1850. There was some improvement in the cattle and in a few sections dairy farming became a specialty. Cheap barns were the rule, with a yard for the cows. The cows were generally milked in the yards.

After the Revolutionary War, when vast tracts of land were distributed to the officers and soldiers and the great influx of immigrants into the Ohio Valley began, much better forage was found for the cattle and the pastures of native grass were more plentiful than in the East. This movement, which was continued from

1800 to 1840, greatly affected all lines of industry, but the opportunity to maintain great herds was very enticing and was not neglected. Bidwell says:

"The rich native pasturage region west of the Allegheny Mountains, was an advantage of first importance. The ease with which their small herds found sustenance and fattened, lightened the labors of the farmers and made the frontier less rigorous. The first arrivals found white clover and Kentucky blue grass. Recent research shows that these (grasses) were spread from the Atlantic Coast. Wild rye was also found."

Some of the agricultural societies were among the first to attempt improvement in the breeding of cattle. The Philadelphia Society was founded in 1785 and by 1800 there were a number of these societies which held displays of cattle, sheep, and implements. The best known men of the day, including many practical farmers, were members of these societies.

The Connecticut Agricultural Society (1854) has records showing that attention was being given to the crossing of cattle for improvement, but this was possibly by the use of selection only.

Some idea of the yield of milk and butterfat of the cows of the period just prior to the advent of the factory system and all the great improvements of dairying through the benefit of machinery and equipment for which it had waited many years, may be seen from the following quotation from Bidwell:

"Judging from the current estimates, the productivity of dairy cows had considerably increased from 1800 to 1840. At the earlier date according to answers to questions from Massachusetts Agricultural Society, 70 to 100 pounds of butter, or 50 to 150 pounds of skim milk cheese, were considered fair amounts for an ordinary cow (about 2,500 pounds). About 1830 it was estimated that a milk cow of medium quality in Massachusetts would give 1,500 quarts of milk in a year (3,225 pounds), which would make 166 pounds of butter or 375 pounds of cheese. New York State, about 1835, a good cow 'under proper management' was expected to produce 200 pounds of butter a year or between 300 and 400 pounds of cheese. One farmer in Herkimer County produced 32,000 pounds of cheese from 78 cows, averaging 410 pounds each. The increase is explained partly by better feed, better care, and better care of calves, taking them earlier from the mothers."

The great increase in population of the cities about 1840 increased the market for dairy products, hence the necessity for the production of more milk per cow, by the development of better cows. There was a great financial depression in 1837 and a falling of prices, however; it was followed by the Preemption Act of



Six Yoke of Oxen on Schooner Wagon, 101 Ranch.

Courtesy of Bureau of Dairy Industry. U. S. Dept. of Agric.

1841, which gave the settlers first right to lands. This act was the greatest boon for the farmers until the Homestead Act of 1861.

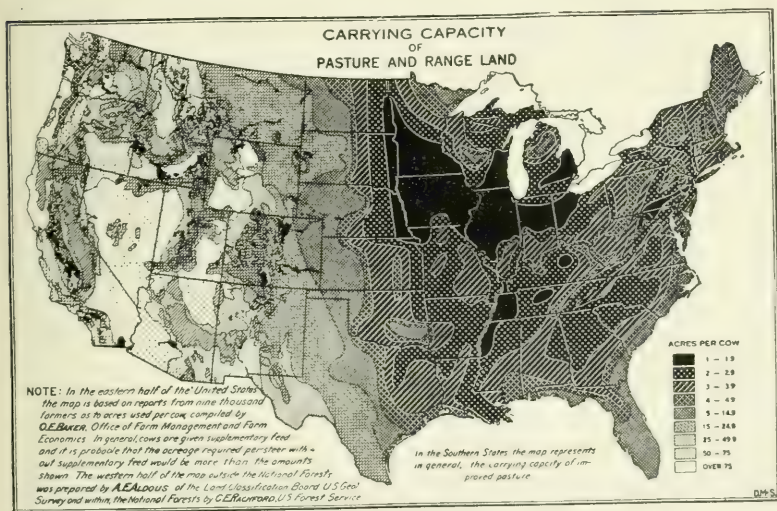
After the year 1851 the railroad lands were placed on the market and the lure of land and the prairies, which latter could not be cultivated until the invention of the steel plow in 1851, caused the sons of the soil to go west and select land. The land was said to be "too cheap and too productive."

The Mexican War, in 1848, and the Gold discovery, in 1849 and 1850, drew from both the farms and cities but the dairy industry of the time was not lost nor was its future menaced by those wild times. As there had been many inventions for the saving of work on the farms and in the raising of grains and producing feeds for cattle during the winter, the labor on farms was reduced until the farmer had more time for his cattle. Such implements as the plow (nearly 100 kinds), the scythe, the mower, the thresher, the self-binder, the corn planter, hayrake, and reaper, were invented and by their use the labor on the farm was reduced at least one-third.

The next step in the development of dairy cattle in the United States was principally and fundamentally through the breeding of

the dairy types pure, establishing herdbooks, and breeding associations for each dairy breed. It is true that there were millions of grade cows giving large quantities of milk and returning a profit to their owners, still even the quality of these grades depended on the purebreds.

From this point forward there will be little or no discussion of any of the beef types, or breeds of cattle, but all the history will refer to dairy or near dairy breeds, including, of course, the grade cattle.



Courtesy of U. S. Dept. of Agric.

DEVELOPMENT OF DAIRY CATTLE—The breeding of cattle is not a new art nor an old science. Before Moses there were many fine cattle and the cattle of the Hindu, the Egyptian, the Aryans, and other ancient races were declared beautiful, and if their sculpture is correct the cattle were beautiful. Morco Polo in the 13th century said "The cattle of every kind are well-sized, fat and exceedingly handsome." It is even wrong to think of all cattle as scrubs, nondescripts, etc., except certain well-known breeds, for the cattle in the wild state or semiwild were beautiful when feed was plenty, and it is claimed that cattle in the wild state were larger than after being domesticated. Babcock and Clausen say:

"The domestication of animals occurred very early in the history of man; so early that accurate historical documents do not carry us back within sight of the time when man first began to take wild animals under his care. . . . Even at the dawn of history, domestic animals had already been developed to a high state of excellence."

In the early ages the cattle were bred by the art of the Arab with his horses, not science nor classical formulae, but the knowing of his animals to the fineness of an art as well as knowing the ancestry of his animals. In fact, when any considerable attention was given the subject of breeding during the past ages, possibly up to 1900, this kind of art was used rather than science.

Occasionally there are startling descriptions of the production of milk of one or more cows, a reputation for breeding of cattle, high honor for a time—and then lost. Some of the early records claimed a milk production nearly as high as the highest records of today—exceeding possibly 30,000 pounds (with some uncertainty as to the measuring utensil).

The cow in her present state of development is the result of centuries of cultivation and care with excellent breeding at intervals and much neglect the remainder of the time. The law of "reverting to type" seems to have almost held its own in many countries and with many breeds of cattle.

Some of the apparent accidental records are: The famous Oakes cow, 1816, which gave 44 pounds of milk daily; a scrub cow owned by George A. Scott, Nashville, Tenn., 1863, that produced 12,450 pounds of milk in a year; and an old Suffolk cow in 1805, which in 5 years produced 52,456 pounds of milk and 2,725 pounds of butter, an average of 10,491 pounds of milk and 545 pounds of butter. This is not at all impossible, and it is also true that some people kept records in the old days.

BREEDS—Many sections of the world have such natural protection that the cattle were not mixed with other cattle to any extent and thus were bred pure for possibly many years; however, without due records of the individuals such a race of cattle would not be considered a breed and proof of purity could not be established. The origin of our present breeds was begun by Robert Bakewell, Leicestershire, England. His method was very simple. He selected a good type and fixed it by close breeding. This was first practiced among the beef cattle and then applied to dairy animals. After the origin of the breeds and much of the develop-

ment of the dairy breeds in England they were introduced into America and the development continued.

The method, for many years, was "breed the best to the best" and "fix the type by close breeding," in fact, there appeared to be nothing better than this method, and where it was wisely practiced splendid results were obtained.

SCIENCE—Science has always desired to solve the problem of life and to be able to control it, hence studies of life have been continuous for years. In 1859 Darwin published his "Origin of Species," which appeared for a time to be the last word in breeding.

In 1865 Mendel's laws of heredity were published and then lost for 35 years. These laws comprise a complicated theory of the process of reproduction and presents an explanation of the many results now being obtained by the art of breeding. These laws were given out to the world for the second time in 1900, and many of their claims have been substantiated by scientific research. According to Rommel these laws may become very valuable when they are better understood and simplified for the ordinary breeder:

A great many data have been accumulated as to the character in animals which illustrate the operation of Mendel's law, but apart from the horns of cattle, coat color, eye color, and the like, the application of this law to live-stock breeding has a long way to go before its principles are adaptable to practical use by breeders. . . .¹

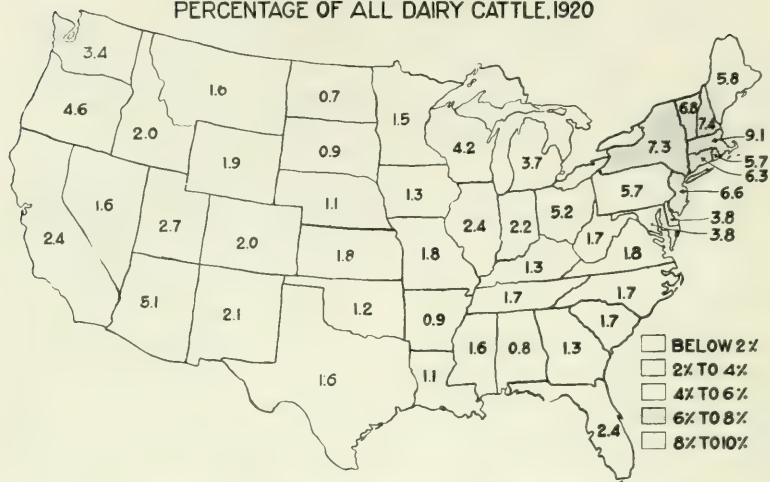
The progress of breeding may be shown, in part, by the increase in yield of milk or butterfat produced by the highest record cow of each of the breeds. There are several methods being used to increase production of milk and butterfat—cow-testing associations, bull associations, and Advanced Registry and Register of Merit of the cattle clubs.

The cow-testing associations systematically test the milk of all cows of the associations, keep definite records of the findings, and make a record of feeds consumed, and give the date of freshening and purity of breed of the animals. By this system the farmer is able to know his best cows and also to know his poorest cows and dispose of them.

There are now 777 cow-testing associations in the United States testing 327,633 cows.

¹ Essentials of Animal Breeding F. B. H67. U. S. Dept. Agric. p. 9. G. M. Rommel.

PERCENTAGE OF ALL DAIRY CATTLE, 1920



The bull associations are established for the purpose of procuring the services of good bulls, proved bulls, at a nominal cost, and to prevent the slaughter of bulls which have been proved.

There are 225 bull associations in the United States as of July 1, 1926.

In the last few years a cooperative agreement has been entered into between the United States Department of Agriculture, Bureau of Dairying, by which about one-half of the cow-testing associations of the country furnish their records to the Bureau of Dairying for tabulation and compilation of results. This brings together the greatest aggregation of definite records ever collected on breeding, feeding, selection, and care of cows.

McDowell says in regard to these records:

"For the first time in the history of this country figures are now becoming available by which the true value of thousands of purebred dairy bulls of each dairy breed may be determined through the records of their unselected daughters. This information is obtained through the work of the cow-testing associations, which furnish the records, not for a few selected daughters, but of all the dams and practically all the daughters, thus telling the whole story."

The development of the breeds for greater milk production is shown in the following tables from the same bulletin.¹

¹ U. S. Department of Agriculture Circular 368, 1926, by J. C. McDowell and J. B. Parker.

Average production of dams and daughters, both purebreds and grades.

	Dams	Daughters
Number of records	2,182	2,182
Average milk yield	8,635	9,012
Butterfat test	3.96 %	4.01 %
Average butterfat (lbs.)	342	361
	Milk	Fat
Pounds daughters exceeded dams	377	19
Per cent daughters excelled dams	4.4 %	5.6 %
Times daughters excelled dams	1,259	1,262
Times dams excelled daughters	923	920

Quoting the same author we have the explanation:

"What does all this mean? Simply that the sires used in cow-testing associations were able to raise the average yearly butterfat production of the daughters above that of the dams until the latter reached 384 pounds. Beyond that point many individual dairy bulls were able to raise the records of their daughters above that of the dams, which the ordinary purebred cow-testing association bull was unable to do."

"The keeping of records of dams and daughters is not enough. Some practical method must be found for keeping a dairy bull until enough of his daughters have been tested to show his worth. If the comparative records become available only after the bull has gone to the slaughter they have lost their value so far as that sire is concerned.

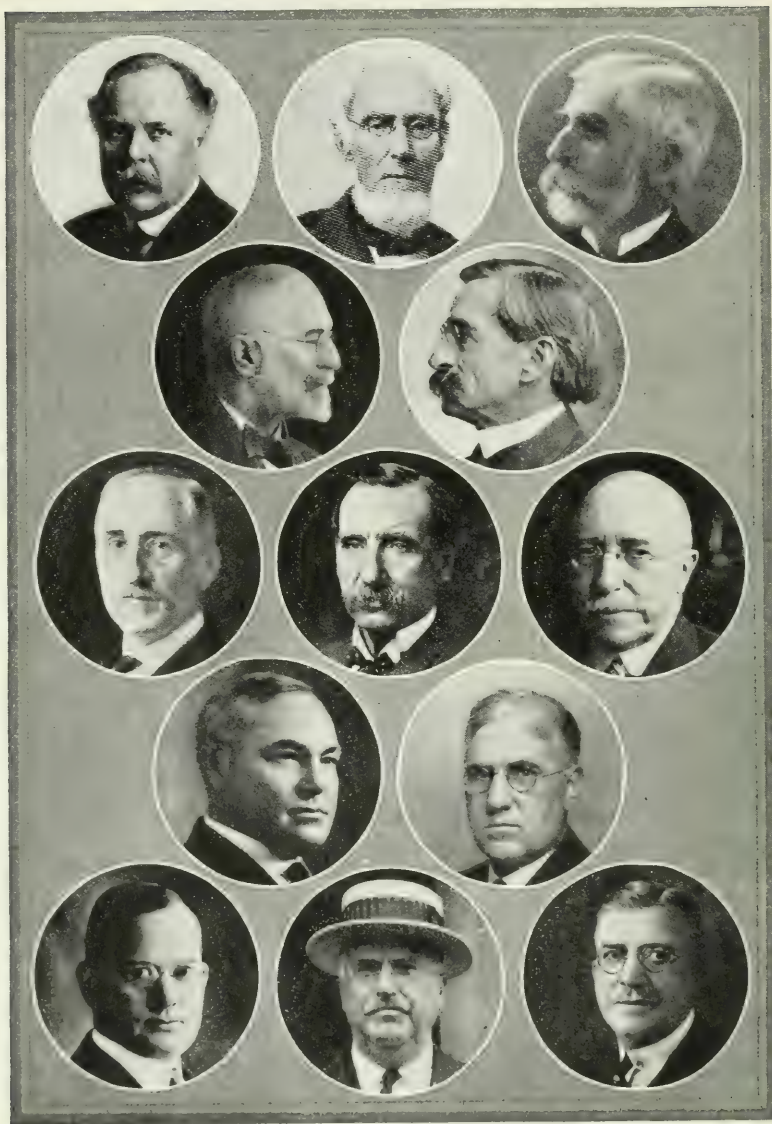
"The purebred, proved dairy sire seems to be the best solution of the dairy-breeding problem. He may be proved through cow-testing association figures, through advanced-registry testing, or through private records."

The proper ideal of a sire is given by Graves as follows:¹

"A great sire of production is one whose daughters have a high average yield of milk and butterfat, a high average increase in milk and butterfat yield over the yield of their dams; and a high percentage of their number better than their dams. All these things must be considered. No one of them alone offers sufficient evidence of the sire's worth."

The progress of the purebred cattle in America has been wonderful as in a few decades cattle are scarcely to be found unless they show some development. The country is full of grades many of them of high production ability but the per cent of purebreds of all cattle, including beef, is only about three per cent. Nevertheless it is true that about 90 per cent of the milk is produced by the

¹ U. S. Depart. Bul. 1372, 1926, by R. A. Graves.



Prominent Dairymen: Names from left to right, top—Dean H. L. Russell, Gail Borden, H. B. Gurler, Dr. S. M. Babcock, T. L. Haecker, E. H. Farrington, Hon. W. D. Hoard, M. D. Munn, B. H. Rawl C. H. Eckles, Dr. C. W. Larson, W. E. Skinner, and Prof. G. L. McKay.

grade cows, that is, three per cent of the cows (purebred) produce 10 per cent of the milk.

Breeders of dairy cattle in the United States, as elsewhere, have worked hard and long, a few leaders bearing the burden for the benefit of all and the number of these pioneers, leaders in heredity research and in practical breeding have always been too few.

One of the latest efforts to improve the breeding of cattle has been in the development of a system of photographing to get comparable pictures. This method allows only side views. It was begun in 1922, and if it comes into general use will make a desirable improvement in the future pictures of dairy cattle.

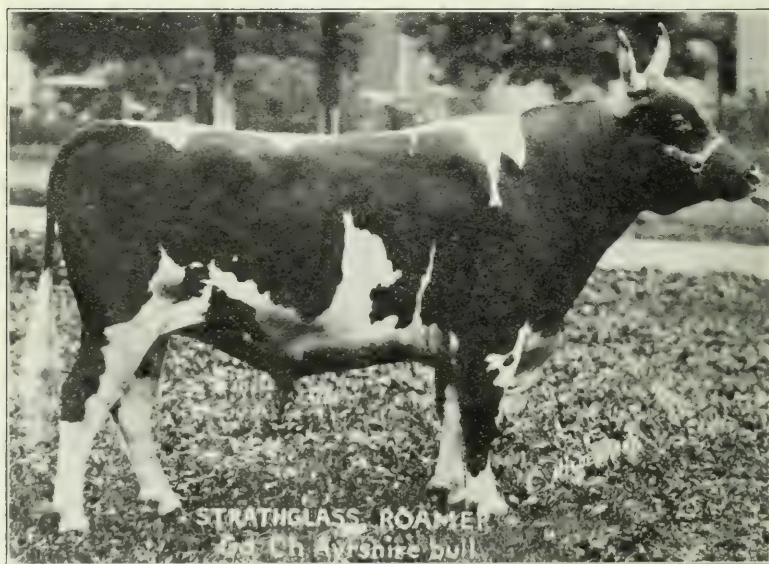
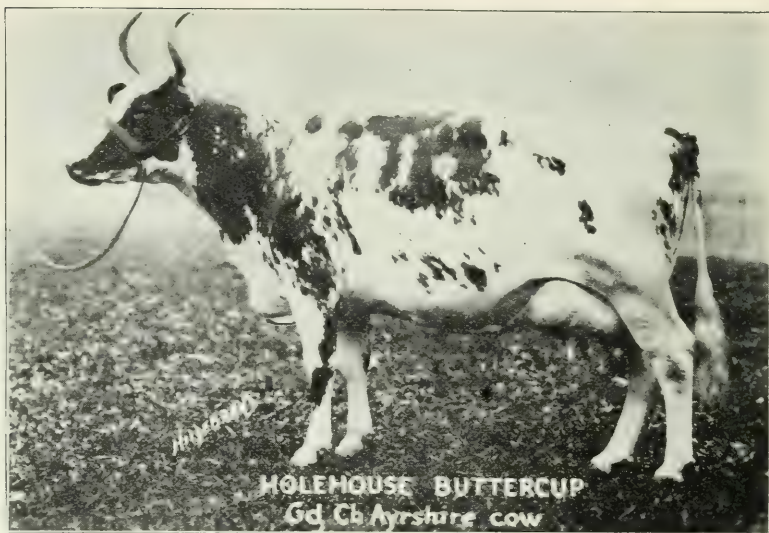
The results of better breeding and intelligently following the best methods available have given the world some very high-producing cows, and it is significant that many of the world records were made by breeders of the United States. Within a few decades the production of milk has been raised from about 10,000 pounds for the highest cow to more than 37,000 pounds in a year. These records were made by the Holstein-Friesian breed while the other breeds made similar advances in milk production.

It is important to note that the development of milk production in the breeds has been obtained without sacrificing the strength, size, or vitality of the breeds.

BREEDS.

AYRSHIRE BREED—The first importations of the Ayrshire breed were made in 1822, and later imports have been continuous, but mostly from Canada. From the year 1885 to 1920 there were imported only 1,762 head, but the total in the country in 1920 was 30,000 purebred and 400,000 grades. These cattle are scattered throughout 38 of the States.

The American Ayrshire Breeders' Association was formed in 1863 and began the publication of a herdbook. The official records of the association showed on January 1, 1924, that 5,790 cows had completed the year records with an average of 10,190 pounds of milk per cow, a butterfat content of 404.36 pounds, and a milk test of 3.97 per cent.



Grand Champions, National Dairy Show, 1925.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

The 10 highest producers of milk and butterfat to Jan. 1, 1924, are given below:

Milk Production		Milk record
Cow		Pounds
Garclaugh May Mischief—27,944		25,329
Mistress Thistle of South Farm—49,818		23,029
Auchenbrain Brown Kate 4th—27,943		23,022
Lily of Willowmoor—22,269		22,596
Garclough Spottie—27,950		22,589
Nancy Whitehall—47,810		22,075
Jean Armour—32,219		21,938
Bloomer's Queen—39,119		21,820
Willowmoor May Mischief 2d a34,173		21,161
Auchenbrain Yellow Kate 3d—36,910		21,123
Butterfat Production		Butterfat record
Cow		Pounds
Lily of Willowmoor—22,269		955.56
Auchenbrain Brown Kate 4th—27,943		917.60
Garclaugh May Mischief—27,944		894.91
Auchenbrain Yellow Kate 3d—36,910		888.33
Agawam Bess Howie—43,781		876.13
Harperland Spicy Lass—40,652		866.21
Jean Armour 3d—32,219		859.65
Nancy Whitehall—47,810		858.77
Bloomer's Queen—39,119		865.41
Victor's Beauty Rose—44,021		840.65



Garclaugh May Mischief, Champion Ayrshire Cow.

Courtesy of Guernsey Breeders Association.

The 10 Ayrshire sires having the largest number of daughters with yearly records, up to January 1, 1924, are as follows:

Sire	Number of daughters
Beuchan Peter Pan—12,971	56
Finlayston—8,882	55
Baron's Best Bargenoch—12,858	43
Earl's Choice of Springfield—8,289	43
Nox 'emall—7,312	35
White Cloud of Hickory Island—10,377	32
Morton Mains Queechy—11,537	27
Netherton Statesman—11,643	27
Kate's Good Gift—15,426	27
Rena's Champion—11,816	26

BROWN-SWISS BREED OF DAIRY CATTLE

By Frank J. Holt

The Brown-Swiss breed not unlike other breeds of American dairy cattle, originated on the other side of the Atlantic. The home of the Brown Swiss is, as its name indicates, the little, mountainous republic of Switzerland.

ORIGIN—History records an interesting story of the breed's development. The exact origin, however, is indefinite. Several different views are held regarding the early history of the breed.

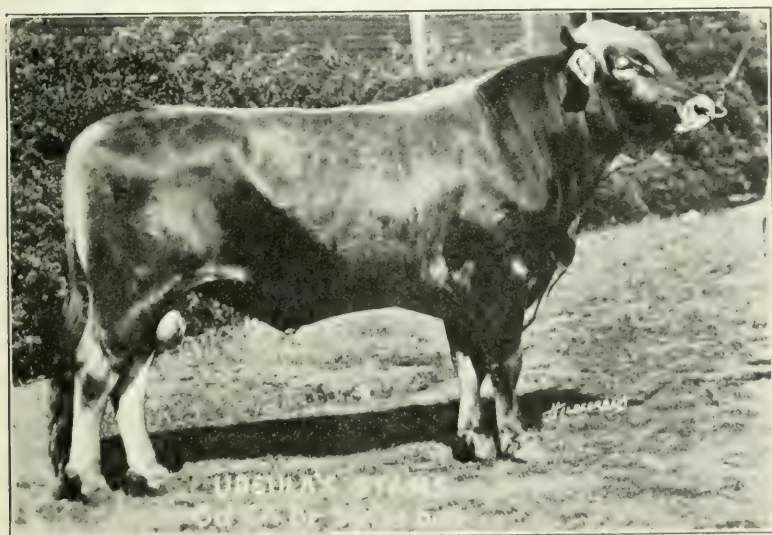
One of these views maintains that centuries ago, when mankind was young, a strong and rugged type of cattle, prototypes of Brown Swiss, roamed the steppes and valleys of western Asia. They gradually traveled westward (into Europe); and, by the time Attila, the Hun, led his armies into the civilized sections of southern Europe, the big, brown cow was found grazing on the mountainsides of the Alps.

The American author, Charles S. Plumb, points out that fossils of horns, skulls, and other bones found in the Swiss lake dwellings, dating back to the bronze age, closely resemble the Brown Swiss of the present day.

Other historians feel that the breed may have originated from Celtic, Burgundian, and Allemanni cattle sometime in the fifth century. While these explanations are widely different, they clearly indicate the antiquity of the breed.



Switzerland, hemmed in by snow-clad mountains, afforded an excellent field for the development of a pure breed of cattle. Kept almost exclusively by the farmers of a number of cantons, notably Schwyz, the breed was not mixed with other cattle, and, conse-



Grand Champions, National Dairy Show, 1925.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

quently, it is today one of the purest of breeds. Breeding of this type led to a marked uniformity in individuals—a very noticeable characteristic of the present-day Swiss.

In Switzerland much of the best pasture land is on the steep mountain sides. The Swiss farmer early found it practicable to send his entire herd to these fields and keep them there for long periods of time. Along the sides of the mountains there are sheer precipices and cliffs, and it is not unusual for a cow literally to fall out of the pasture if she gets too close to the edge. This training in hill climbing has done wonders for the Swiss cow, having developed a strong constitution, increased her size, and made her a thrifty grazer.

Famous as a producer and manufacturer of cheese and other dairy products, Switzerland needs a large quantity of milk to supply those industries. Such a market encouraged milk and fat production and the Swiss farmer has selected for breeding purposes his best-producing stock.

In their home country it is not uncommon to see Brown Swiss serving as triple-purpose cattle—not only for milk and meat but also for labor. Both cows and bulls are used for plowing and hauling.

Economical in all his undertakings, the Swiss farmer, for centuries (and he does it even today) has kept his dairy herd under the same roof where he lives. Such an intimate contact between the owner and his cows has tended to make the cattle docile and gentle. There is nothing high-strung about Brown Swiss.

These Swiss conditions have played an important role in the development of the breed. Five decades of American breeding have served to accentuate many of the desirable characteristics that resulted from centuries of Alpine breeding.

The first Brown Swiss set foot on American soil in 1869. This first importation, consisting of seven heifers and a bull, was made by Henry M. Clarke, of Belmont, Mass. The next shipment was not made until 13 years later, but in that period the original herd had multiplied until there were about 200 head scattered throughout the Northern and Middle States.

In 1882, Nelson B. Scott, of Worcester, Mass., and George Harris, of Wetherfield, Conn., made the second importation, consisting of 10 animals—nine heifers and a bull. These animals were quickly sold to Connecticut farmers, and in the fall of the

same year, Scott and Harris made another shipment. These, too, were sold, most of them going to J. Brier, of New York. A third lot of imported heifers, with a bull of the first importation of Scott and Harris, went to Abe Bourquin, of Illinois.

Other importations that followed included that of William Kock, of New York, who, in 1884, brought over five heifers and a bull. And about the same time Messrs. Eldredge and Ryder, both of New York, shipped a dozen head, consisting of a 3-year-old cow, 10 heifers, and a bull. Another importation of prominence was made by McLaury Brothers, of New York, in 1904.

E. M. Barton, a prominent breeder, who made a shipment of 14 head in 1889, was so pleased with the big, brown cow, that in 1906 he made his second and also largest importation that ever crossed the ocean. It consisted of 39 animals, 34 carefully selected heifers and 5 bulls.

In all, not more than 200 Brown Swiss were brought to the United States from Switzerland. An embargo,¹ due to the prevalence of disease, was placed by the American Government on cattle from Switzerland. But from this relatively small importation, nearly 40,000 purebreds have been registered (1926) on the herd-books of the national association. Besides this number, thousands of grades have been developed from the imported stock.

American breeders have greatly improved the type of Brown Swiss. Though the early cow was rather coarse and heavy, especially over the head, shoulders, and brisket, the typical American cow is strictly a dairy animal. She is smooth and refined but not delicate.

The average weight of the milk cows ranges from 1,300 to 1,400 pounds. The cows, when going dry, take on fat readily but give it off slowly during the milking period. Mature bulls weigh from 1,750 to 2,500 pounds. The calves are large at birth, gaining rapidly in weight and make excellent veal.

Though the color varies, the most common color, as their name indicates, is brown. Bulls are dark-seal brown except over the spine and on the ears and muzzle, at those points the brown is several shades lighter than on the rest of the body. Cows run light-brown to dark-steel gray, with light-colored muzzles and ears.

¹Imports of cattle from Holland or cattle coming through that country was prohibited about 1885, although some shipments were received.

Brown Swiss are noted for their gentleness of disposition, and the bulls have marked masculine tendencies. Up to July, 1925, 576 official records had been entered in the three branches of the Register of Production. In the yearly test 457 cows, that were tested, averaged 12,361.1 pounds of milk and 494.96 pounds of fat; in the 10 months' test, 95 cows averaged 10,340.5 pounds of milk and 410.3 pounds of fat; and in the farmer's: class 27 tested cows averaged 9,548.7 pounds of milk and 393.26 pounds of fat.

The average test shown by these official records was 4.0 per cent fat.

Two cows have produced more than 1,000 pounds of fat, 4 have exceeded the 900-pound mark and 12 have made more than 20,000 pounds of milk each. The champion of the breed (1926) is June's College Girl, owned by Dr. C. F. Osborne, of Hampton, Iowa, which, as a 5-year-old, completed a yearly test of 24,571.6 pounds of milk and 1,062.3 pounds of fat. As a 12-year-old, Believe, owned by F. P. Minette & Sons, of Sauk Center, Minn., produced 25,847.8 pounds of milk and 1,002.62 pounds of fat, her milk record being the highest of the breed.

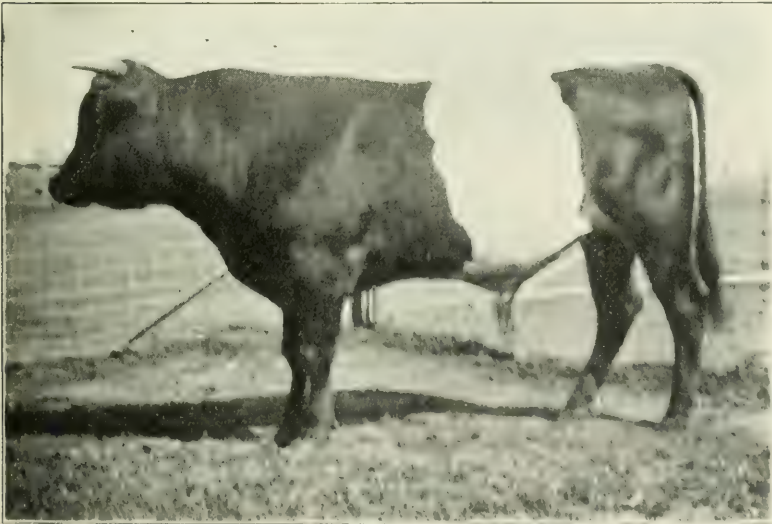
Because of their ability to produce both milk and calves profitably, even after they pass the age of 8 or 10 years, Brown Swiss are noted for their longevity of production.

More than 50 bulls have qualified as proved sires (1926). Swiss sires are admitted to that honor list when three of their daughters out of different dams have qualified for the register of production. Reuben, with 24 daughters, heads the list.

Brown Swiss appears to be well adapted to all parts of America. Under the coldest weather of Canada and the hottest climate of Mexico, they have responded nearly as well as in the middle western states, where they have made their greatest number of friends. Though they are found in nearly every State of the Union, they are most numerous in the Corn Belt States, with Wisconsin topping the list, closely followed, in the order named, by Illinois, Minnesota, Ohio, Iowa, Michigan, New York, and Pennsylvania.

An active association, that was organized as early as 1880, directs the affairs of the Brown Swiss cow in America. In the fall of 1925, the Brown Swiss Breeders' Association was incorporated and permanent offices were established at Beloit, Wis. The present secretary of the Association is Ira Inman, of Beloit, Wis., and A. E. Bower, of Cleveland, Ohio, is its president.

The association publishes a monthly magazine known as the Brown Swiss Bulletin. Other publicity matter is distributed from the national office. Assistance to buyers and sellers is rendered by the Brown Swiss Cattle Breeders' Association of Beloit, Wis.



Sire and Dam of Dutch Belted Cattle,
Courtesy of Dutch Belted Cattle Club.

DUTCH BELTED CATTLE—While the origin of this breed is uncertain, it is known to have been pure bred in the Netherlands for many years and is thought to have had its beginning in common with the Black-and-White, Friesian breed.

The breed is not numerous in either Europe or the United States; however, in 1920 there were 6,000 purebred and 150,000 grades. The first animals were brought to the United States in 1838 and for a long time, says Alvord, they were more numerous in the county of Orange, N. Y., than in all other parts of the country put together. It is said that P. T. Barnum had some of these cattle brought over in 1840 for show purposes, as they were so striking in appearance—the glossy black with the white sheet about their middle. The total imports from 1885 to 1920 amounted to only 69 head.

In this country the Dutch Belted Cattle are recognized by the Dairy Science Association as a strictly dairy breed. The Dutch Belted Association was incorporated in 1909 and has published 12 volumes of the herdbook of the breed. Up to April 1, 1924, the number of females registered was 3,300 and the males 1,600. In 1920 the association formed an Advanced Registry department and have some very creditable records on Standard Dairy Methods which this association uses. This method includes "official tests on two milkings a day with practical feed and care."

The following table gives the ten highest Dutch Belted, yearly butterfat and milk production, records made in the United States from cows that have finished prior to January 1, 1924:

Milk Production		Milk Production	
Cow	Milk Pounds	Cow	Milk Pounds
Gem of Columbia (2,038)	17,268.2	Peapack Anna (1,487) . .	13,159.0
Angelina (2,641)	16,022.6	Peapack Dutchess (1,390)	13,065.0
Fern dell (1,961)	13,477.9	Orange Lily (3,126) . .	11,575.0
Priscilla of Lakeview (2,937)	13,385.0	Eunice (1,597)	11,479.2
Glenbeulah's Beauty (2,172)	13,295.8	Fritzi (1,832)	11,353.0

The average yield of milk for all cows that have finished prior to January 1, 1924, is 9,771 pounds, and 362.34 pounds of butterfat, with an average test of 3.71 per cent.

This breed is now found in almost every State of the Union but the greatest number is found in the states of New York and New Jersey.

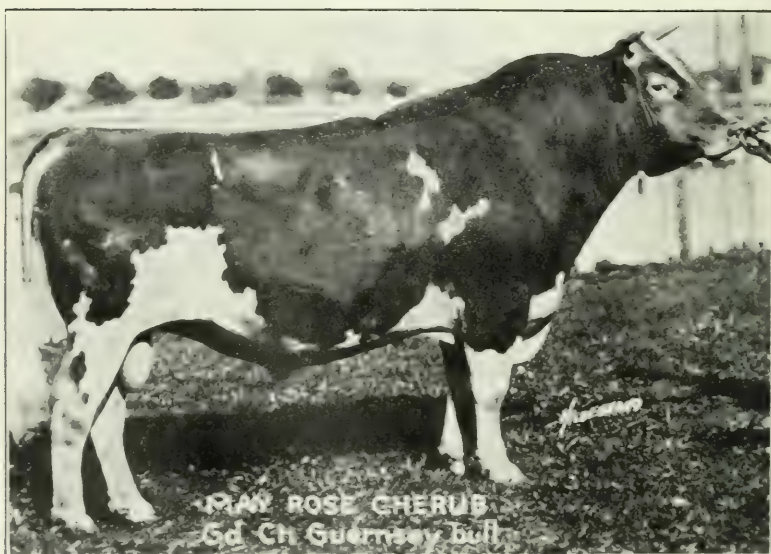
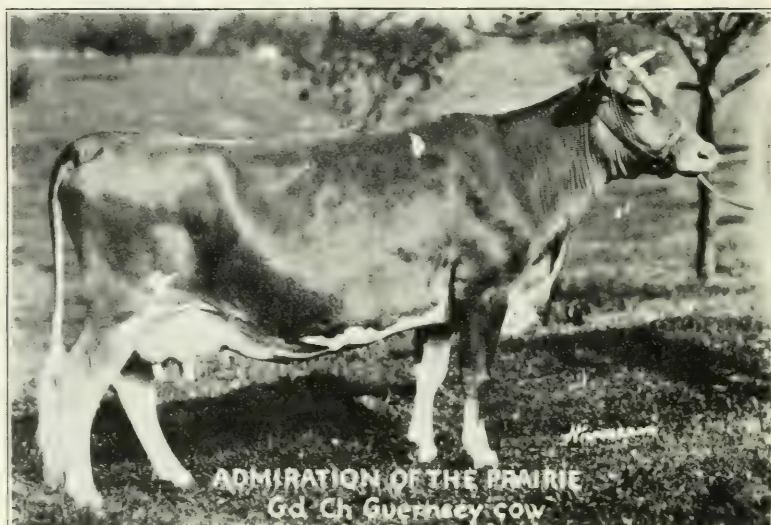
GUERNSEY CATTLE—This breed of cattle originated and was developed in the Channel Isles long before it was brought to America. (The history of this breed in its home land is given in the chapter on United Kingdom.)

The Guernsey was one of the latest breeds brought to the United States. There is some confusion in the early records as for several years the cattle from the Channel Isles were mostly classed as Alderney cattle, but later they were called Jersey and Guernsey cattle, the cattle from Stark and Alderney being generally called Guernseys.

IMPORTATIONS—The first importations were made by Mr. Pierce of Boston, Mass., in 1830 and 1831, and in 1833 a bull and two heifers were imported and sent to Cow Island, N. H., (now Maine). From these two foundation herds many fine animals were produced. The next Guernseys brought over were three cows which were later registered as Number 1, 2, and 3 in the Cattle Club Herd Register. These cows were brought to New York, September 26, 1840, by Nicholas Biddle. In 1851, James P. Swain, Bronxville, N. Y., brought from Alderney 1, from Guernsey 2, from Stark 1, and from Jersey 2, but in this importation it is claimed there was only one excellent cow with a calf named "Cottie." A picture made April, 1868, is believed to be the first picture of a Guernsey cow made in the United States.

Other small importations followed in 1855, 1865, 1870, 1872, 1874, 1878, and 1879. In 1883 there was an importation of 80 head by S. C. Kent and Hughes of West Grove, Pa., directly from the island of Guernsey, but they were affected with foot-and-mouth disease. None of them died although some of them lost horns, and hoofs—the calves all lived and it is reported that no abortions occurred in the herd. These importations continued and from 1885 to 1920 the total imports amounted to 10,114 head of Guernsey cattle of all kinds.

An early record of milk production was that of Richard Morris, January 11, 1817, in which he says that an Alderney cow fed



Grand Champions, National Dairy Show, 1925.
Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

as usual on pasture yielded 8 pounds of butter a week and when put on test later produced $9\frac{1}{2}$ pounds in a week. The test of milk in this breed varies from 3.5 to 5.5 per cent butterfat.

DEVELOPMENT—The American Guernsey Cattle Club was organized in New York, N. Y., February 7, 1877, for the purpose of managing the activities and development of the breed and furthering the interests of its members.

The herd register (herdbook) was established and the first volume published in 1884. It contained the names of 539 bulls and 1,394 cows. At the present (1925) 17 volumes have been published which show that during the 41 years there had been registered 11,185 bulls and 20,859 cows, that is a total of 32,044 animals.

In 1902 the Advanced Register was established for the breed.

The work of furthering the interests of the members and advertising the breed have been carried along by the use of fairs, auction sales, and especially by the use of the National Dairy Show each year at which the champions of the breed are selected by competent judges.

In 1893 there were 25 head of cattle representing the Guernsey breed sent to the World's Fair at Chicago, Ill.

Breeders' associations have been organized in many States but the breed has been distributed through the country, the greatest numbers being in the States in the order named—Wisconsin, New York, Pennsylvania, Ohio, and Minnesota.

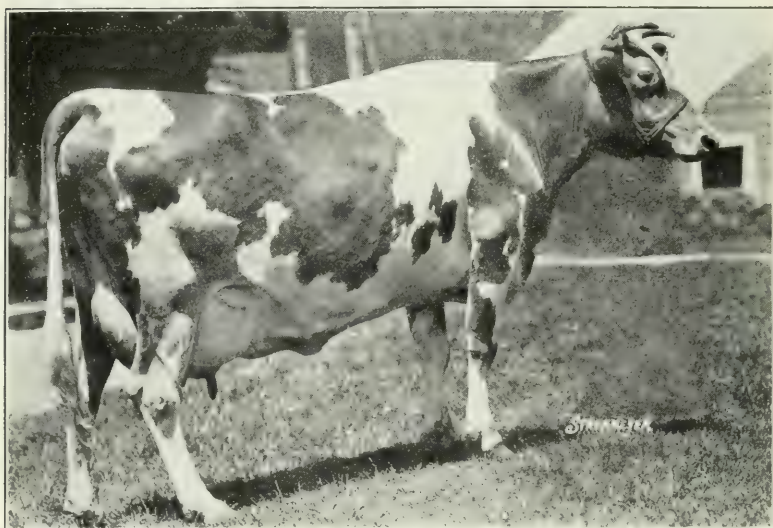
The total number of Guernsey cattle in the United States, as estimated in 1920, was 1,933,000 including grades.

The yield of milk of this breed varies as in all breeds but the breed has had some very high producing cows. The improvement since 1902 is seen in the yield of the highest production of milk recorded year by year as follows:

	Pounds		Pounds		Pounds
1902	11,623	1905	14,921	1914	19,673
1903	11,675	1909	18,459	1915	24,008
1904	14,633	1912	18,603		(Highest to date)

This record indicates an increase of 500 pounds of milk per year for the highest producer of the breed.

The number of purebreds registered in the year 1900 was 1,504, and in 1925, 32,041.



Anesthesia Faith of Hill Stead.
Courtesy of Guernsey Breeders Association.

The average yield per cow for 19,631 head that have completed official records up to January 1, 1924, was 9,359 pounds of milk, containing 468.3 pounds of butterfat, the milk having an average test of 5 per cent.

The 10 highest milk and butterfat producers of the breed are listed below (June, 1926):

Annual records of Guernsey cows in the United States.

Milk Production			
Milk record		Milk record	
Name of cow	Pounds	Name of cow	Pounds
Murne Cowan (19,597) . .	24,008.0	Tom's Daisy (54,541) . .	20,297.7
Katherine's Trixis		Jean Du Luth Coronet	
(100,396)	21,071.4	(52,816)	20,004.0
Nella Jay 4th (38,233) . .	20,709.9	Langwater Hope (27,946)	19,882.0
Molly's Lassie (86,472) . .	20,591.9	Yeksa's Top's of Gold's	
Miss Daisy of Maple Hill		Fannie (22,362)	19,794.9
(72,610)	20,314.8	Anesthesia Faith of Hill	
		Stead (114,354)	19,741.9

Butterfat Production

Name of cow	Butterfat record Pounds	Name of cow	Butterfat record Pounds
Anesthesia Faith of Hill		Langwater Nancy (27,943)	1,011.7
Stead (114,354)	1,112.5	Dairy Maid Queen of Spring	
Countess Prue (43,785)	1,103.3	Hill (74,067)	1,011.2
Murne Cowan (19,597)	1,098.2	Langwater Hope (27,946)	1,003.2
May Rilma (22,761)	1,073.4	Lillia of Iowa 2d (61,500)	998.4
Nella Jay 4th (38,233)	1,019.3	Yeska's Top's of Gold's	
		Fannie (22,362)	981.5

The 10 Guernsey bulls having the largest number of daughters with official yearly records up to January 1, 1924, are listed below:

Name of sire	Number of daughters
Governor of the Chene (1,297)	112
Yeoman's King of the May (17,053)	84
Masher's Sequel (11,462)	70
Langwater Demonstrator (16,451)	66
Galaxy's Sequel (16,004)	53
Clara's Sequel (29,414)	52
Ne Plus Ultra (15,265)	46
Cora's Governor of Chilmark (9,871)	46
Beda's May King (11,893)	41
Justinee's Sequel of the Preel (2,119)	39

HOLSTEIN-FRIESIAN BREED—The first importations of this breed which were bred pure were imported by W. W. Chenery during the period of 1857 to 1863. The Miller brothers, of New York, brought over cattle in 1867 and these importations were followed by many others. Of course the early Dutch settlers of New York brought their cattle with them but how long these first cattle were kept pure is not known. The total importations from 1885 to 1920 were only 1,864 head; however, the breed had been well started and grew rapidly making further importations unnecessary. The outbreak of the foot-and-mouth disease in Europe also prevented imports from the Netherlands.

The total of Holstein-Friesian cattle in the United States in 1920 were 528,000 purebred and 10,500,000 grades. The breed is well distributed with the largest numbers in the following States in the order named: New York, Wisconsin, Pennsylvania, Ohio, Michigan, and Illinois.

Before 1885 there were two associations furthering the inter-



Grand Champions, National Dairy Show, 1925.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

ests of this breed in the United States, and two herdbooks were being kept—the Holstein herdbook and the Dutch-Friesian herdbook. In 1885 these two associations were united and the compromise named adopted—Holstein-Friesian Association of America. It is unfortunate that the name "Holstein" was retained, as it appears to have no foundation in the origin of the breed, and the Dutch breeders have called attention to this fact since the time it was first used. These cattle are called "Friesian" or "Hollandaise" or plain "Dutch" cattle in all other countries.

The official records of the Holstein cows and heifers completed to January 1, 1924, show an average of 15,508 pounds of milk and 526 pounds of butterfat, the milk testing 3.39 per cent.

The 10 highest milk producers and butterfat producers in the Holstein-Friesian breed in the United States, up to January 1, 1924, were as follows:

Milk Production	
Cow	Milk record Pounds
Segis Pietertje Prospect—221,846	37,381.4
Helm Veeman Woodcrest—486,877	36,217.7
Kolrain Marion Finderne—317,396	35,339.5
Kolrain Finderne Bess—291,570	35,085.4
Nooksack Lunde Oregon De Kol—301,119	34,510.9
Queen Carlotta De Kol—311,674	34,430.3
Adirondac Wietske Dairy Maid—204,072	34,401.9
Grahamholm Calantha Pouline Segis—405,465	34,291.8
Princess Aaggie Polkadot De Kol—372,024	34,070.5
Grahamholm Colantha Segis Maid—405,466	33,811.6

Butterfat Production	
Cow	Butterfat record
De Kol Plus Segis Dixie—295,135	1,349.31
May Walker Ollie Homestead—300,043	1,218.59
Hollywood Lilth Palmyra Abbekerk—400,491	1,206.79
Duchess Skylark Ormsby—124,514	1,205.09
Bess Johanna Ormsby—263,431	1,198.09
Finderne Pride Johanna Rue—121,083	1,176.47
Segis Pietertje Prospect—221,846	1,158.95
Dutchess Pietertje Creamelle—394,861	1,148.54
Grahamholm Colantha Pauline Segis—405,465	1,141.40
Adirondac Wietske Dairy Maid—204,072	1,136.15

The ten sires having the largest number of daughters with yearly records, up to January 1, 1924, are as follows:

Sire	Number of daughters
Sir Pietertje Ormsby Mercedes—44,931	56
King Pontiac Champion—53,418	50
Woodcrest Teehe—74,219	50
Sir Johanna Fayne—42,147	48
King of the Pontiacs—39,037	42
Sir Inka Prilly Segis—80,914	39
Dutchland Colantha Sir Inka—50,999	39
Sir Pietertje Ormsby Mercedes 37th—110,160	37
King Segis Pontiac Count—93,909	34
Colantha Sir Walker Korndyke—95,460	29

At the present time there are 54 cows which have records exceeding 30,000 pounds of milk which was produced in one year.

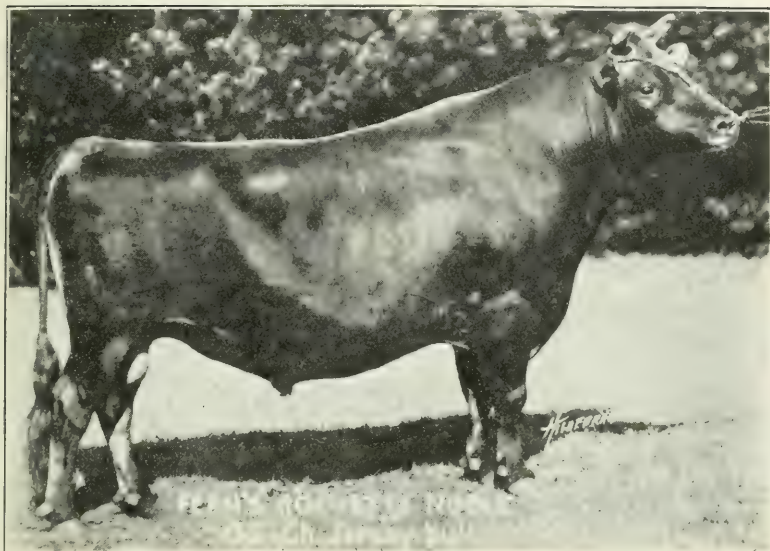
JERSEY CATTLE—After Jersey cattle were introduced into the United States, prior to 1850, it seems that their development began very soon and has since been pushed with earnestness. Occasional importations continued up to 1885 and from that date to 1920 there have been imported 6,304 head.

As the Royal Jersey Agricultural Society (Isle of Jersey) began to develop systematically by drawing up a scale of points and establishing a standard, it is evident that the first cattle of this breed imported into the United States had already been started in the way to the present development.

The numerical increase can be seen by comparing the small number imported with the number in 1920, when there were in this country 232,000 purebred and some 9,300,000 grades. While this breed is one of the smallest of the dairy breeds still the large milk production and butterfat yield make it one of the principle breeds, and it is now found in every State of the Union.

The American Jersey Cattle Club was founded in 1868 by Messrs. George E. Waring, Jr., C. M. Beach, Thos. J. Hand, and S. J. Sharpless. The first volume of the herdbook was issued in 1871 but at the present time there have been 108 volumes of the herd register published. These registers contain the pedigrees of 234,000 bulls and 620,000 cows, a total of 854,000 animals.

A system of official testing was adopted in 1884, and in 1897



Grand Champions, National Dairy Show, 1925.
Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

the butter produced had to be confirmed by the use of the Babcock tester. The Register of Merit was established in 1903. The Club permits records for periods of 305 days and not exceeding 365 days.

On January 1, 1924, 18,250 cows and heifers had been recorded in the Register of Merit and their milk production averaged 8,580 pounds, the butterfat averaged 460 pounds and the test of the milk was 5.36 per cent.

At present there are about 35,000 breeders of Jersey cattle in the country.

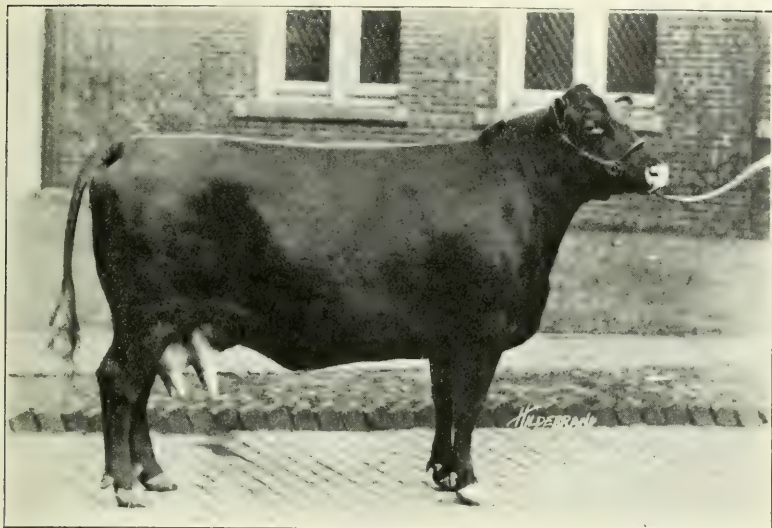
The 10 highest records for milk production and butterfat production of Jersey cows in the United States to January 1, 1924, is given below:

Milk Production

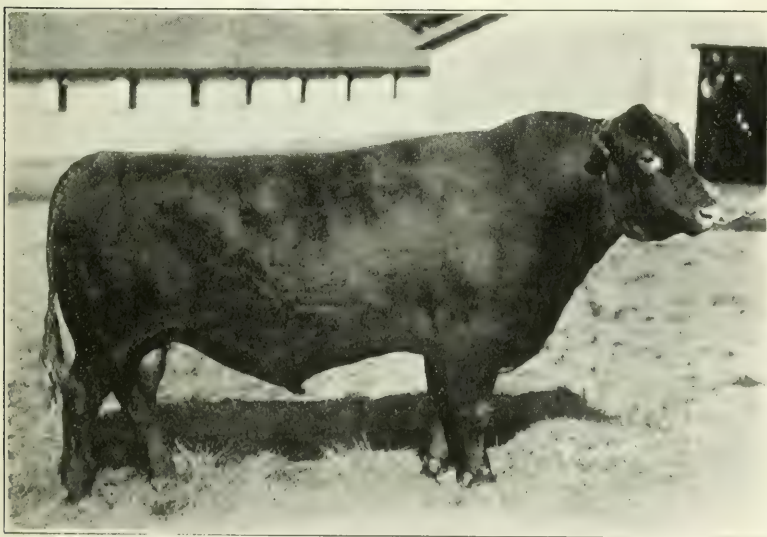
Cow	Milk record Pounds
Madeline of Hillside—389,336	20,624
Fauvic's Star—313,018	20,616
Abigail of Hillside—457,241	20,359
Passport—219,742	19,695
Lad's Likeness—338,246	19,223
Eminent's Jimp's Owl—297,471	19,099
St. Mawes Blossom Rosaire—355,800	19,061
Miss Inez—377,204	18,917
Raleigh's Sybil—372,752	18,847
Eminent's Bess—209,719	18,783

Butterfat Production

Cow	Butterfat record Pounds
Darling's Jolly Lassie—435,948	1,141.28
Goff's Constance—367,292	1,130.09
Prince's Emma of H. S. F.—359,390	1,109.99
Lad's Iota—350,672	1,048.07
Fauvic Ruth—385,463	1,047.28
Madeline of Hillside—389,336	1,044.05
Plain Mary—286,206	1,040.08
Vive La France—319,616	1,039.29
Lady's Silken Glow—313,311	1,038.70
St. Mawes Lad's Lady—451,568	1,032.97



Red Polled Cow.



Red Polled Bull.

Courtesy of Brown Swiss Cattle Club.

RED POLLED CATTLE—This dual-purpose breed was developed in England and is noted for meat and milk production. The early types of this breed were soon badly mixed, as the cows were crossed with Alderney sires, but after 1873 the number was large enough to be maintained pure. (See the United Kingdom for history of origin.)

The first regular importations of Red Polled cattle was in 1873 when G. F. Taber, of New York, brought in 1 bull and 3 heifers. In 1875 he imported 4 more cows, and in 1882, 3 bulls and 23 heifers; also in the same year Mead and Kimball, of Vermont, imported 1 bull and 10 heifers. After that year the numbers were increased and the records show that from 1885 to 1920 there were imported a total of 520 Red Polls.

The total number of Red Polls in the United States in 1920, including grades, was 1,772,000, about 2.6 per cent of the total cattle of the country. The largest numbers of this breed are in the Southern States and East North Central section of the country.

In November, 1883, the Red Polled Cattle Club of America was organized in Chicago, Ill., and a Herdbook begun. The foundation cattle registered in the herdbook were each given a letter of the alphabet to indicate the family.

As dairy cows of Red Polls have made no phenomenal records, but the average of the best herds would be a credit to any breed. The yield of milk is not equal to that in England but it is said that the fat test is higher.

Some of the highest records are as follows:

Year	Milk Pounds	Butterfat Pounds
1908	11,422	435.34
1909	11,889.5	602.53
1913	13,160.6	603.66
1914	13,538.4	546.34

The breeders of Red Polls claim for them consistant milkers, and excellent beef. The cows are at the height of the milk production at 10 years of age.

There is a story of a Red Polled cow that gave milk for nine (9) years after the last date of freshening. (2728 Crocus Oil by Cato 468.) The cow was milked from June 19, 1890, to September 30, 1899, the total production for the nine years was 50,593 pounds and the cow weighed 1,831 pounds when slaughtered.

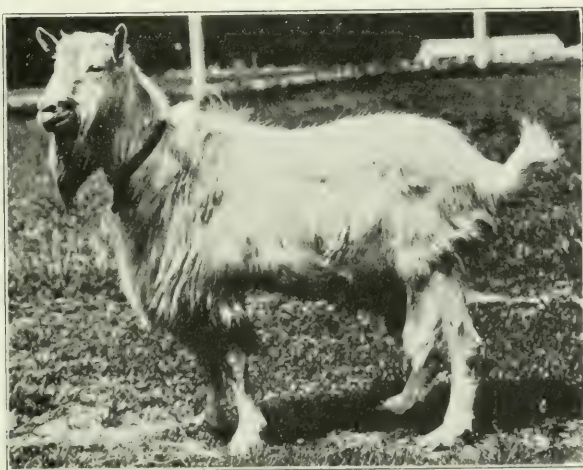
GOATS—Goats have been in America nearly as long if not quite as long as other domestic animals. Besides pets there has always been a demand for goats for the production of milk, as in the Eastern Hemisphere.

A number of goats have been introduced from the finest breeds in the world. The Saanen and Toggenburg from Switzerland and the Nubian, or Anglo-Nubian from Africa. These breeds are generally used for the production of milk but there are a number of other varieties which give milk in small quantities but are used mostly for the production of mohair and for meat.

It is believed that the Saanen goat has remained true to type for 30 generations and is therefore a very pure breed. This is most important in view of the fact that the goats have been continuously mixed for many centuries in Europe and Asia—even back to the 5th century.

The only goat native to America is the Rocky Mountain goat but it has never been domesticated.

PRODUCTION OF MILK—The best Saanen goats are heavy milkers, averaging 2 to 3 quarts a day for 10 months. The Saanen is the largest of the Swiss breeds. They are white and generally hornless. The Saanen has a record of 19 pounds and 5 ounces of milk produced in one day and the same goat has a record of 4,005.4 pounds yield of milk in 10 months and 2 days.



Saanen Buck.

Courtesy of Bureau of Animal Industry, U. S. Dept. of Agric.

A Toggenburg doe holds a record of 4,350 pounds of milk containing 138.56 pounds of butterfat in 12 months, and the same goat in 15 months gave 5,008 pounds containing 161.31 pounds of fat.



Anglo-Nubian Buck.

Courtesy of Bureau of Animal Industry, U. S. Dept. of Agric.

The Anglo-Nubian (or Nubian) is built up from crossing Nubian bucks from Africa with the English does. The doe of this breed are tall, with drooping ears, are of various colors, and are generally hornless. (It is interesting that after at least a thousand years of effort to breed the horns off the goats it has not been done completely.) The milk of this goat is richer than the others. A good milk goat of either breed will average 1 to 2 thousand pounds of milk a year.

Goats are said to be entirely free from tuberculosis and the butterfat is lighter than that of the cows and is thought to be more easily digested.

FEEDING—In the best herds the kids are taken from their mothers at birth and raised on the bottle or the pan. This may be an advantage to the kids and also to the development of the milking qualities of the does.

Goats are excellent in the trimming of plants and weeds from a pasture but their feed is not all of that character, as milk goats respond to good feed and care. The feed for goats is about the same in kind as for cows and 6 or 8 goats will consume about the same as one cow.

ASSOCIATION—The American Milk Goat Record Association is the official organization of the breeders in this country and is keeping the records of the different breeds of goats. A doe must give 5 or more quarts of milk a day to be admitted to the advanced class.

The present standards as given in the *Goat World*, their official paper, is:

"A gallon in 24 hours for three days in succession, or as an official equivalent, three quarts per day for 150 days, tested every 30th day, with two quarts daily for the next 150 days, similarly tested, and two quarts at the close of the 300 day period."

Numerous herds of goats are in California and Colorado. The herds in California are used monthly for market milk production but those in Colorado produce milk, most of which is made into Italian cheese.

The number of goats in the United States does not give any



Toggenburg Goats.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

information as to the number used for milk but the total in 1920, according to the census, was 3,564,000.

FEEDS AND FEEDING—

GRASS AND FORAGE—The purpose of the discussion of the grass areas in the United States, and other countries, is in the fact that grass, hay, and forage, are fundamental to dairy cattle and wherever grass and forage can be raised in abundance there is a natural region for dairying and the reverse is equally true.

The distribution of dairy cattle in the United States is determined by the quantity and kinds of forage and pasturage available and by the location with reference to markets and the suitability of the land for agriculture.

WILD GRASSES AND HAYS—The wild grasses which covered the Mississippi Valley and westward to the mountains have been a great benefit in aiding a settlement of that territory and in the maintenance of range cattle. Cattle fatten well on the green grass of the prairies but wild grass is not so good for hay; hence other feeds must be used with it. In the Western States much of the hay produced is from this wild grass. The bluestems, the wild oats, and the so-called salt grass are some of the principal kinds suitable for cattle.

Wild grass pastures in this country covers about 10 times as much area as the tame-grass lands but produce only about twice as much sustenance. The low production of the wild grass pastures is due to the impossibility of fertilizing them but the tame-grass pastures show a low-production average because of neglect. In 1921 74,225,000 acres of land produced only 96,802,000 tons of hay.

EXTENT OF PASTURES AND GRASS LANDS—According to the United States Department of Agriculture, the pasture lands in 1919 covered 1,055,000,000 acres, being 55 per cent of the total land area. The pasture lands may be divided into improved, unimproved, arid, and semi-arid lands.

During the last 30 years the pasture land in the United States has decreased annually about 3,000,000 acres. The greatest per capita acreage of pasture and range land was reached before 1880,

the greatest per capita of livestock in 1892, and the greatest per capita of acreage of crops in 1900.

The trend of American agriculture is toward the production of forage crops at the expense of pasture. But after the forage crops have been developed to the full it is estimated that there will be at least 600,000,000 acres in pastures which are unsuited for forage production or crops, therefore, beef production from grass will not pass from the United States.

The country is divided into sections according to the rainfall, kinds of grass and forage, as well as elevation and climate.

The Cotton Belt may be considered as the Southern States extending westward to the middle of Texas and to the north Arkansas line. About 53 per cent of the crop land of this belt is used for the production of feed for cattle, mostly corn, cowpeas, introduced into South Carolina about 1770, velvet beans and peanuts. Corn is used for forage and the cattle consume 90 per cent of it in this region. The average production of hay and fodder is 17 tons per square mile, but the average crop of cotton seed is 12 tons and it is also important. Roughly, one-third of the cotton seed is used for fertilizer and planting, one-third exported, and one-third fed to animals.

The Corn Belt lies just north of the Cotton Belt to the south boundary of Minnesota and thence east to the coast. In this belt the land used to produce cattle feed is fully three-fourths of the total, and the wheat which is a part of the other crops furnishes middlings, and bran—a feed for livestock. One-fourth of the wheat is used for mill feeds for cattle, while the hay and forage production averages 150 tons of hay and fodder, and about 150 acres of pasture per square mile.

The hay and dairy belt extends from the Corn Belt to the northern boundary and is about one-seventh of the land area of the country. Hay is the principal crop and occupies about 33 per cent of the crop land, while corn for fodder and silage use 6 per cent more in addition to the forage crops which occupy about 30 per cent. This belt maintains about one-third of the dairy cows.

The western half of the United States may be considered together as one region, as the climate is generally dry, except in a few localities on the west coast, and there is much arid and semiarid land. In that portion of the country only 6 per cent of the land is used for crops, and of this three-fifths is used for producing stock

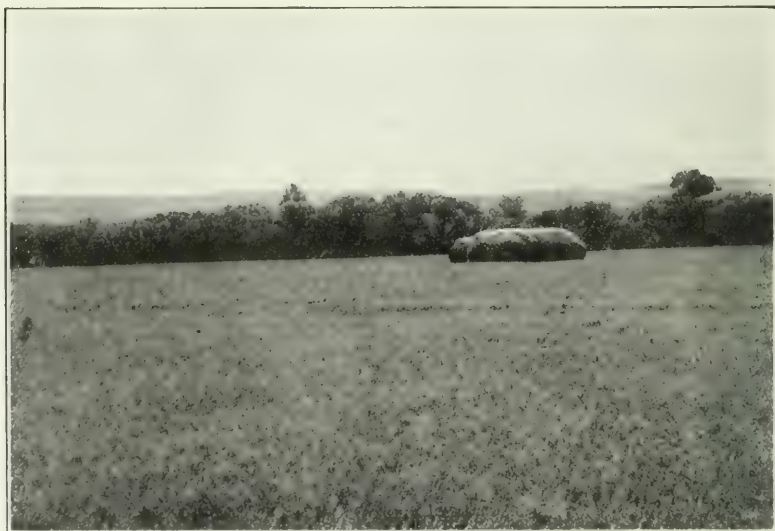
feed. The native grasses of this region are light, the average yield being even less than in the eastern half of the country.

When the individual States are considered it is found that all but one use 50 per cent of their land, or more, exclusive of pastures to raise feed for livestock.

The great incentive to dairy farming is based on ability to produce forage and rear cattle and the principle of the economy of this method of agriculture are based on the facts: That no artificial fertilizers can take the place of animal manures in maintaining the soil and crop yields; many of the forage crops are legumes which when decaying add nitrogen to the soil; the grasses break up the soil with their roots; and that cattle can convert great quantities of roughage into human food.

TAME GRASSES—There are a number of tame grasses which are very important in the economy of feed production in this country. The tame-grass pastures in 1919 totaled about 100,000,000 acres.

ALFALFA—Alfalfa is one of the oldest legumes in the world, having an origin in western Asia at a date beyond human records. It was carried to the west by the Persians and introduced



Second Cutting of Alfalfa, Bazaar, Kans.
Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

into Greece in 490 B. C. The Romans had it in the first century and it was carried to Mexico about the time of the conquest and spread to Peru and later to Chile. From the latter place it was carried to California in 1854. At an earlier date it had been raised in gardens in the eastern part of the United States.

Alfalfa (lucerne) makes excellent hay (the name is Arabic and means "best fodder") and may be pastured but is not so good for silage, as it becomes slimy. This one feed can take the place of grain in the ration of the dairy cow in the production of milk. At present it constitutes over 19 per cent of the total hay crop of the entire country. The acreage in 1924 was 10,453,000 and it has doubled in acreage each ten years since 1899. The average yield in the United States is 2.2 short tons per acre. It is estimated that practically 300,000 tons of alfalfa are ground into meal each year for use in commercial and mixed feeds. Kansas and Nebraska lead in alfalfa production.

The other legumes which are used in part for feed are, cowpeas, field peas, soybeans, field beans, peanuts, vetch, and velvet beans. These crops in general are grown both for grain and for hay. Cowpeas are becoming important in the Southern States, although in some places the soybeans have almost displaced them.

CLOVERS—The clovers rank fourth as a forage crop in the country. There are a number of kinds which are important—red, alsike crimson (introduced in 1796) sweet clover, lespedesa or Japan clover and bur clover. In the main clover region, which is east of the Mississippi River, it is estimated that the proportions are 65 per cent red clover, 30 alsike, and others 5 per cent.

SWEET CLOVER is used principally as a pasture crop although it is cut for hay, silage and soiling. It is noted for the number of cattle it can carry per acre. In 1924 there were 8,600,000 acres in clovers of all kind.

TIMOTHY was introduced into the United States by a Mr. Timothy, hence its name, and is now an important crop when used with clover but is not well suited for milk cows. It is grown mostly in the eastern half of the country.

BLUEGRASS—This grass was introduced into Kentucky and the entire northeastern part of the United States at an early

age in the Colonial period. It is an important crop and well suited to the rearing of livestock. It is a pasture grass and tends to occupy the richer soils.

SORGHUMS—The term sorghums comprises sorgos or sweet sorghums, the grain sorghums, such as kafir, milo, and feterita, and broomcorn. None of these sorghums are natives of this country. They are of greatest value in the semiarid sections, as they are specially drought-resisting. In 1919 there were 9,000,000 acres devoted to sorghums. The principal region for this forage begins in northern Texas and reaches to the north boundary of Nebraska, covering most of Kansas, Nebraska, and Oklahoma.

ROOT CROPS—The root crops are small in quantity produced when compared with other forages. In 1919 there were produced only 598,945 tons of root crops.

SILAGE—The use of silage in the United States is perhaps more popular than in other countries. It takes the place of soiling and furnishes a succulent feed for the cows during the winter. In the year 1919 there were harvested nearly 4,000,000 acres of corn as silage, while 14,500,000 acres of corn were made into fodder. There are many thousands of silos in the country but most of them are in the dairy sections, or where dairying is the principal occupation. The State of Wisconsin has more than 100,000 silos.

There has been much discussion as to who built the first silo and the earliest date found so far is 1873, when Fred L. Hatch built a silo in McHenry County, Illinois; however, in 1881, Professor Roberts, of Cornell University, N. Y., built a silo for experimental purposes.

SOILING—This is more a method of handling and feeding than it is a feed although it is similar to silage in that it is not a dry feed, soiling being grass or grain cut green and fed at once and the silage being cut green and cured.

FEEDING DAIRY COWS—Much has been learned about the feeding of dairy cows and the knowledge thus obtained has been largely put into practice. It was early learned that cattle required a variety of feeds in order to maintain their bodies and to produce milk. If the proper feed was not furnished the cows would give less milk and lose weight. Studies were made for years to deter-

mine the proper feed or ration of the cow to meet her requirements—to produce body tissue, furnish heat, work, and milk. Many attempts have been made to develop a standard for farm animals under different conditions. From the results of these studies standards have been established which show the amount of fat, carbohydrates, and proteins supposed to be adapted to different animals when kept for different purposes. The bases for these standards have varied as to the unit—the Danish uses the standard feed unit, the German the energy unit, while others use the nutrients, or starch.

As all these standards are based on the digestibility of the feed it may be thought that there had been many experiments on the actual digestibility of feed, but the opposite is true. The principal experiment in the United States was made by the Pennsylvania station with a number of steers and the findings of that test have been used ever since, but at present there is much doubt as to its applicability to the feeding of cows in milk.

SCIENTIFIC RESEARCH—There have been many important facts established by scientific investigation in recent years. The studies of the scientists have followed several lines—the effects of the feeds most desired by the cow, the kinds of feeds which maintain the milk flow and the body weight, and a study of the chemicals in the milk and in the feeds with a view to furnishing the chemicals in the feed which are needed in the milk. The results of all the important investigations are published by the colleges or experiment stations as well as in the dairy press.

There have been a number of feed standards established beginning about 1810, when Thayer published hay standards in Germany, and feed (grain) standards were produced in 1859 by Grouven. Wolff (Germany) in 1864 presented the first table of feed standards based on digestible nutrients contained in the feed. These tables were brought to the United States in 1874 and published in Armsby's *Manual of Cattle Feeding*. Armsby formulated a table based on energy values for ruminants but it was based on experiments made with a number of steers. Haecker, of the Minnesota experiment station, was one of the first to show that the feed should vary with the quantity of milk and butterfat produced. Savage, of the New York station, also produced a table of feed standards. Humphrey, Woll, and Morrison each produced

standards and worked for a better understanding of the feeding of dairy cows.

Experiments have proved that green grass contains more protein than cured hay and that it also contains more of the anti-scorbutic and fat-soluble vitamins than the dry hay, as shown by the milk produced. The superiority of green grass has been known for years but not the reason.

The value of feeding properly, the care of animals, and the proper breeding are subjects which are not clearly defined, as much of the improvement in milk yield may be due to either of these factors without its being apparent. The importance of excellent husbandry in care and handling is hard to overestimate, but the proper feeding from generation to generation gives fine animals, unless it is counteracted by the breeding.

There are about 100 kinds of grasses which are suited to cattle feeding. Some part at least of all grains can be used, while the root crops also furnish much feed for cattle. New feeds are being discovered and various green stuffs are being used for silage. Concentrates and roughage together with the millions of acres of pasture make an excellent foundation for the dairy industry in the United States.

COMMERCIAL FEEDS—Commercial feeds are generally made from the by-products of many processes and industries, such as vegetable oil mills, starch factories, sugar mills, flour mills, breakfast food factories. According to J. L. Wills, (Vt. Bul. 246, 1925), there are now more than 5,000 factories making feeds in the United States and in 1920 the Bureau of Census estimated the value of the product at more than \$1,000,000,000, hence the industry appears to be not only immense in size but must be rendering a really great service. It is needless to say that the feeds do not all go to the dairy industry as these feeds are prepared for all kinds of livestock and fowls.

Commercial feeds in general are covered by the following classification:

Wheat by-products—Bran, middlings, mixed feeds, red dog flour, and screenings.

Rye by-products—Middlings, and mixed feeds.

Corn by-products—Hominy feed and corn meal.

Oat by-products—Hulls, middlings, shorts, "clipped oats by-product" and oat feed.

Starch and glucose factories—Corn gluten meal, corn gluten feed, corn germ meal, hydrox.

Oil Mills—Cottonseed meal, cottonseed feed.

Flaxseed by-products—Linseed meal, screenings, oil cake meal.

Peanut by-products—Peanut meal. Oil.

Cocoanut by-products—Copra or cocoanut meal.

Miscellaneous—Soy bean meal, cocoa meal, dried beet pulp, molasses, blackstrap molasses, tankage, dried blood, bone meal, alfalfa meal, and dried buttermilk.

The volume of these feeds is given by the Federal Trade Commission for the average annual output, (1913-1920) as follows:

Wheat by-products (including imports)	4,827,000 tons
Oat feed (including imports)	169,000 tons
Glucose by-products	433,000 tons
Cottonseed meal (domestic used for feed)	1,057,000 tons
Linseed meal	214,000 tons
Dried beet pulp	150,000 to 200,000 tons

The volume of commercially prepared feeds is ncreasing rapidly and the dairymen are among the best customers.



Raritan Valley Farms, Raritan, N. J.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

COW-TESTING ASSOCIATIONS—Before cattle were domesticated they ran wild in the woods and on the prairies. In those days they produced just milk enough to feed their calves. To produce more was likely to lead to udder troubles, and possibly to disease and death. To produce less was likely to bring about starvation of the offspring. In either case that branch of the bovine family was cut off and those that produced enough for their calves and not too much became the mothers of the cattle family. Their descendants were finally domesticated by man.

After cattle were domesticated some of the cows were kept to produce milk as food for man. In many cases the calf was killed in order that all the milk of the dam might be available for the family of her owner. From that time on the high-producing cows were most in demand. It was not, however, until the offspring of higher-producing cows were kept that much progress could be made toward a strain of the dairy type.

Even if we knew all the facts it would not do to attempt to give them because it would require a long, long story to tell how our present high-producing dairy breeds were developed from such a low-producing ancestry. It is enough for us to know that they have been so developed that there is a tendency for them to revert to type. If no attention were given to selection, feeding, and breeding, it would require only a comparatively few generations to reduce the production a long way toward that production that just sufficed to keep the calf alive.

Progress can be achieved only through eternal vigilance. This is true in every line of human progress but it seems to be especially true in dairying. Production per cow in dairy countries is higher now than ever before in the world's history, and it is not going to go back to a lower level so long as our present civilization lasts. On the other hand, it will go on and on to higher and still higher levels. The best of the purebred herds and the best of the grade herds have pointed the way. They have shown what can be done. What has been done toward increasing production in so many herds can be accomplished in other herds.

All dairy-herd improvement in the past may be traced to three things: selection, breeding, and feeding. All dairy-herd improvement in the future must be based also on selection, breeding, and feeding. Which of these three is most important no one can say, as all are absolutely essential if there is to be much improvement.

Though the average milk production of the dairy cows of the United States is only a little more than 4,000 pounds there are many herds that produce on an average more than 8,000 pounds per cow. As population increases more dairy products will be needed. The greater quantity of dairy products may be obtained by keeping more cows or by keeping better cows. As time goes on the need for more dairy products should be met through increased production per cow.

The cow-testing association, as ordinarily conducted in this country, is an organization of about 26 dairy farmers who cooperatively employ a man to test their cows for economical production of milk and butterfat. The tester visits the farm of each member of the association once a month, at which time he obtains the daily feed record of each cow in the herd as well as her record for milk and butterfat. He multiplies the day's record by the number of days in the month and copies the results in the herd-book. This is continued during the testing year. The low producers are culled out and the cows remaining are fed according to production.

The first cow-testing association in the United States was organized in Newaygo County, Michigan, in 1905 by Helmer Rabild, assisted by Simon Hagedorn, and began work in January, 1906. The work has had a constant and fairly rapid growth as shown by the following figures:

Number of cow-testing associations by years:

Year	Number of Associations	Year	Number of Associations
1906	1	1920	468
1910	40	1925	732
1915	211	1926	777

The total number of cows on test in these associations is 327,633. Their production of milk and butterfat is about 60 per cent above that of the average dairy cow in this country.

In many associations there is a gain in production per cow each year and this is also true of many herds in most associations. The average butterfat production per cow in three typical associations over a period of 5 years was as follows: First year, 237 pounds; second year, 255 pounds; third year, 278 pounds; fourth year, 292 pounds; and fifth year, 305 pounds. In one association

a certain herd had an average butterfat production per cow of 234 pounds the first year; 244 pounds the second year; 302 pounds the third year; and 315 pounds the fourth year. These gains in association averages and in herd averages are what may be expected in well managed associations.

BULL ASSOCIATIONS—The cooperative dairy bull association is a farmers' organization whose chief purpose is the joint ownership use, and exchange of three or more high-class purebred dairy bulls. Each bull heads all the herds in one block of the association. To prevent inbreeding, each bull is moved forward to another block every two years.



Tested Sire and Daughters.

Courtesy of Guernsey Breeders Association.

The first bull association in the United States was organized in Michigan in 1908 by the University of Michigan. In numbers, the bull association has grown quite constantly as the following figures show:

Year	Number of Associations	Year	Number of Associations
1908	3	1920	123
1910	9	1925	220
1915	15	1926	225

From 1908 to 1925 the gain was comparatively rapid but the gain of the last year for which figures are given, is quite small.

Like the cow-testing associations, the bull associations are getting good results. Yearly individual cow records of 155 daughters of bull-association bulls have been tabulated and the records compared with the records of the dams of the daughters. On an average the dams produced 7,112 pounds of milk and 299 pounds of butterfat; and the daughters on the average produced 8,071 pounds of milk and 342 pounds of butterfat. In milk production the gain of the daughters over the dams was 13.5 per cent and the gain in production of butterfat was 14.6 per cent. For both dams and daughters the records of immature cows were figured to maturity in the usual way; the records of the two-year-olds being considered 70 per cent the, records of the three-year-olds 80 per cent, and the records of the four-year-olds, 90 per cent of mature production. (J. C. McDowell.)

DAIRY MACHINERY AND ITS PART IN THE DAIRY INDUSTRY

By S. J. Van Kuren¹

(Written especially for this history)

CONDITIONS PRIOR TO THE USE OF MACHINERY—Machinery and methods used in the handling of milk and its products 50 to 75 years ago, compare with equipment of the present day about as weapons of the cave dwellers compare with modern implements of warfare.

In fact the dairy industry had no recognition at that time.

The importance of milk and other dairy products as a human food and the value of the dairy cow as a direct source of revenue as well as her contribution to the successful production of other farm crops were unknown. Therefore, education in these matters was lacking. For these reasons and also because the industry was young and the principles of sanitation unknown, there were inadequate facilities for the production, care, transportation and marketing of dairy products.

Dairy farms were practically unknown. Most farmers kept a few milk cows to which they paid very little attention. The milking, care of the milk, making of butter, feeding the calves and small duties of that nature usually fell to the housewife. In addition to innumerable other duties, on the average farm, she milked the cows, strained the milk into shallow pans, and then at some future time skimmed the cream by hand off such of the milk as might not be required for the table; the surplus cream she placed in the old-time dash churn there to remain until enough for a churning had accumulated and it had become properly "soured." She then converted it into butter by energetically moving the dasher up and down for a period of time depending upon the age, acidity, and temperature. Acidity was a term unheard of, however. The development of acid in cream was called souring and if it did not develop to a degree satisfactory to the housewife when she wanted butter and the churn became filled to a certain

¹ Furnished by the J. G. Cherry Co., Cedar Rapids, Iowa

limit, she placed it near the stove to hurry the process. If the butter did not "come" soon enough she poured in some hot water. Nothing was known regarding proper churn temperature, moisture content, butter breaking into granules, body, texture, mottles, etc. The butter came in a mass, not in granular form, salt was worked in and buttermilk out by use of the hand ladle and the wooden butter bowl. The color depended entirely upon the season. The finished product was formed into rolls or packed in small jars and the surplus beyond the family table requirements sold to the village grocer or rather traded to him for such merchandise as might be needed. Usually he gave the market price in trade and sold for the same price in cash.

In the smaller towns a large per cent of the people kept a cow, sometimes two cows, and made their own butter. Those who did not, bought milk daily by way of the one, two, or three-quart pail and the small boy route, and their butter from the store or direct from some farmer's wife. The city milk supply consisted in most part of a few barns right in town containing a few cows owned by some man who made a living by the sale of milk, peddling it in the early morning from cans in a cart propelled by hand until his business grew to a point that would support a horse and buggy or wagon of some kind. The patrons' requirements were measured in a quart, pint or half pint measure.

Ice cream, a strictly hot-weather luxury looked upon as an extravagance to be enjoyed but seldom except by the wealthy classes, was prepared in the basement of confectionery stores and in the old style vertical hand-power freezer operated by way of a crank and small boy who earned a dish of cream as fruit of his labor.

Cheese in those days was produced in limited quantities by means of the most crude and ancient equipment conceivable. Presses composed of large wood tubs with holes bored through the bottom and heavy stones for weights followed by the hand-power press in itself a very crude affair.

Sanitary methods were unknown, science, art, or skill in connection with the handling of dairy products were unheard of. The dairy industry, as an industry, was still unknown.

The dairy cow upon the farm classed with chickens—whatever was produced in the way of milk, butter, and eggs beyond

the requirements of the home table was traded at the store for groceries and supplies that the farm itself would not produce.

This touches but lightly upon the picture of conditions governing the dairy food supply of those days and only to give you an idea, if possible, of the marvelous changes that have come about during the last thirty years or a little more.

CREAMERY BUTTER MANUFACTURE—The writer is unable to state upon authority just when creamery butter making began in this country, as his own personal experience in the art dates back only 24 years, and at that time it appeared to be in its early stages of development. However, it is known that in the eastern part of the country cheese factories and creameries were established shortly after the middle of the last century.¹ Cream separators were quite generally used in creameries before 1900 and at that date were very rapidly displacing gravity methods of separation on dairy farms.

With a creamery location selected the farmers within a radius of 10 or 12 miles were induced wherever possible to increase their herds of milk cows, "raise" the cream by filling shallow pans, skim it by hand and hold the cream in cans, pails, jars, etc., for the arrival of the cream hauler who covered a given route with team and wagon two or three times a week in summer and once or twice a week in winter (1875). He carried with him a cream-gathering pail of certain dimensions with a measuring stick graduated to units and fractions called "inches" or "points," each so-called "inch" representing the estimated depth of cream of average density that would produce a pound of butterfat. For each patron's cream a sample was taken in a cylindrical glass tube also graduated and called a cream test tube (1880).

The cream after being measured and a sample taken was dumped into a 20- or 30-gallon, wood-jacketed cream-hauling can and delivered to the creamery, there to be held in plain water-jacketed vats (box-shaped vats with tin linings fitted inside, allowing space for water around each tin compartment). In the jackets or outer compartment of these vats steam or ice was used to heat or cool the cream as might be necessary.

This cream, as will be readily apparent, reached the creamery

¹ First creamery built by Alanson Slaughter, Wallkill, N. Y., 1861.

in every conceivable condition, but almost none of it as sweet, clean, fresh product. There were no means available to check the ravages of undesirable bacteria, the overdevelopment of acids and no provision for even properly straining it beyond a coarse wire or perforated tin strainer. Most farm housewives continued to make their own butter and in most cases very little care was given the cream that was destined for the creamery.

Creamery butter had a bad reputation in most districts where it was produced. Everyone seemed to feel that the creamery was a legitimate dumping ground for any old kind of cream and with each patron feeling that all the others were doing it the result was that very little care or attention was given the product. The country people felt that creamery butter was good enough for city people who "knew no better."

After treating the cream to application of heat or cold as the weather conditions might dictate, it was run into oblong-shaped, square-box wood churns (patented in 1884—David Curtis, Ft. Atkinson, Wis.)—supported by trunion posts or sometimes hung between building posts or supports with an opening in one side covered by a removable door and at the end of the churn on the gudgeon shaft a pulley driven by a belt from the overhead line shaft, with which the churn was revolved and the necessary agitation thereby applied to the cream.

The churning process completed, buttermilk drawn off, the butter rinsed with well water, it was taken out of the churn by hand and "worked" on a flat, round-table-style working device (1885) driven by belt, pulley, and gears with one or two cone-shaped ribbed or corrugated wooden rollers in a horizontal position at one side of the table, leaving a certain space between the surface of the table and the underside of the rollers through which the butter passed and was subjected to a pressure. The operator stood beside this "working" table and with a wooden ladle or paddle continued turning the butter and piling it upon itself to intensify the pressure of the rollers. When finished this product was nearly all packed in wooden butter tubs of various sizes, 10 to 60 pounds each, and shipped to city markets.

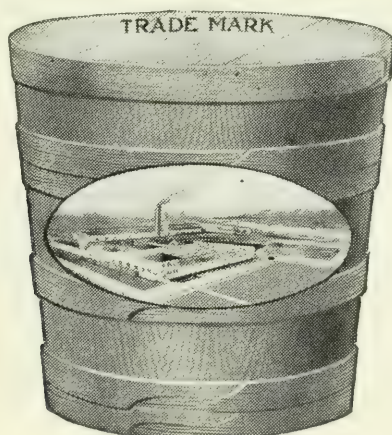
In addition to the above-described equipment each creamery had a device called a test churn consisting of a power-driven shaker that held the iron racks into which the test tubes, turned in by the

driver and containing samples of each patron's cream, were held and subjected to a rapid horizontal shaking motion which churned the butterfat and thus indicated the value of each patron's cream.

A steam boiler and engine completed the necessary equipment of the creamery above described.

About the time the original creamery came to be recognized as a permanent establishment little improvements had also made their appearance in farm dairy equipment.

An improvement in farm utensils, for instance, came into use in the way of cylindrical-shaped cans tapering to the bottom,



Butter Tub.

Courtesy of J. G. Cherry Co., Cedar Rapids, Iowa.

where a faucet was attached, into which the milk was poured and permitted to stand until the cream had raised to the top, then the milk was drawn from underneath first, after which the cream would be drawn off into a separate vessel, but such efforts as were made to improve the quality of the cream sent to the creamery were few, of a scattered nature, and altogether spontaneous. Very little progress in that direction was noticeable.

However, the dairy cow began to receive some little recognition from her owner as a reliable, dependable source of regular weekly or monthly checks and in those days the average farmer was never overburdened with ready money. Therefore, as a current cash producer "bossy's" popularity began to grow.

Creamery butter, however, met with very little popularity. The demand was confined principally to those who could get

nothing else. Its reputation was none the best. Most consumers preferred butter made on the farm by some neat, clean-appearing farmer's wife or daughter. This was due, to some extent, to the very badly warped and distorted idea in the public mind as to the method or process used in creamery-butter manufacture in the better class of creameries together with the facts so much better known as to the methods used in most plants where little attention was paid to sanitary conditions and where no one bothered much about quality. This situation brought about the first marked change in the process of buttermaking—the first radical step toward improvement in quality, namely, the factory cream separator, the introduction of which sounded the death knell of the old gathered-cream plant (1885).

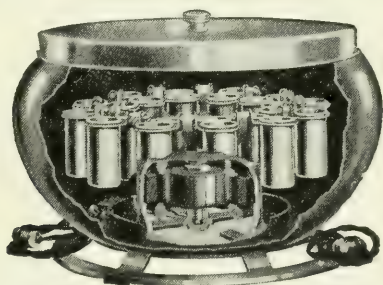
MODERN CREAMERY—Under this new plan creameries sprung up almost like mushrooms overnight, these plants drawing from a small local territory where cows enough could be found to support it. Instead of the cream-gathering plan, as heretofore described, the milk was delivered every morning, weighed in at the receiving window, credited to each patron upon the basis of pounds, dumped into receiving vats from which it flowed to the separator, a centrifugal-power device which separated the cream, after which the skim milk was returned to each patron in proportion to the amount of milk he had delivered, less the percentage of cream removed by the separating process.

The creameries dealt with their patrons upon the basis of butterfat values, and it, therefore, became evident that some accurate and reliable means of determining the exact amount of fat in each 100 pounds of milk must be provided. Butterfat is the actual oil contained in milk. The difference between the finished product, called butter, and butterfat is that the former is made up of butterfat and other solids such as casein (curd), salt, etc., together with a small percentage of water, termed moisture, whereas, as above stated, the butterfat is the pure oil. The basis upon which the value of all milk is figured is that of its butterfat content.

BABCOCK TEST—The necessity of some means to determine the percentage of fat accurately, brought out the invention of the Babcock test (1890). In place of the old method of churning the sample of cream in a glass tube to determine its butterfat

content, a very crude and unreliable method at best, the Babcock test determines to a fraction as small as one-tenth of one per cent the fat content of the sample of milk or cream. Percentage of butterfat means the number of pounds of fat to a hundred pounds of milk or cream. The average milk tests from 3 to 4.5 per cent fat. The percentage of fat in cream depends upon the mechanical adjustment of the separator.

The Babcock test operation consists of accurately measuring each sample of milk into a bottle with a long, slim neck which is accurately calibrated, then mixing with the sample of milk a certain amount of sulphuric acid, revolving the testing machine at a high speed and filling with water until the top of liquid comes high enough in the graduated neck of the bottle to read the amount of butterfat or oil which separates and rises to the top.



Jaleo Electric Tester.

Courtesy of Mojonnier Bros. Co., Chicago, Ill.

The advent of the Babcock test proved of immeasurable value in the progress and development of dairy herds on the farm. Before that, little was known regarding the comparative value of dairy cows. This depends entirely upon the pounds of milk produced and the percentage of fat it contains. Farming is a business—dairy farming especially, and unless a cow produces to the extent that results in a profit, she is not an asset but a liability. She must be charged with what it costs to keep her and credited with what she produces. Some cows test as low as 2.5 per cent fat, others as high as 6 per cent or even higher. One hundred pounds of 6 per cent milk is worth more in fat value than 200 pounds of milk of 2.5 per cent fat. Thus it will be easily seen that some means is vitally necessary to determine the actual producing value

of each cow in the herd. The Babcock test solves this problem through the production of the small, hand-power tester used on the farm which enables the owner of any herd to weed out the unprofitable cows and replace them with the other kind.

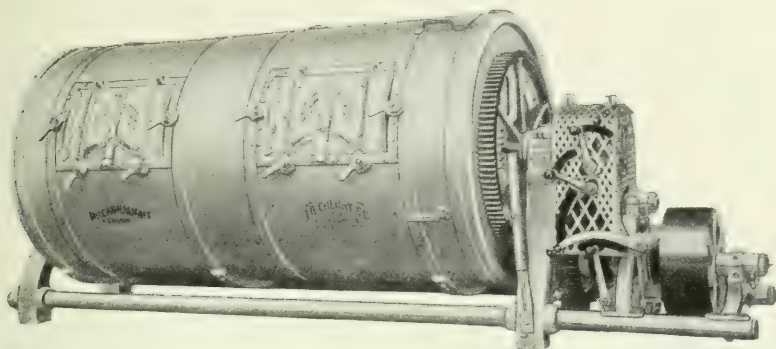
This small device, for testing milk, therefore, small though it is, may be considered one of the most important steps in the part that mechanical invention has played in the development of the dairy industry. It stimulated a marked increase in dairying everywhere, because it turned on the searchlight of profit-vs.-loss on the business of feeding and milking dairy cows and taught the dairy world the value of breeds and breeding and pedigreed stock for the production of milk and butter.

A very decided improvement in the quality of creamery butter was made possible by the development of the factory separator plan. Milk that has developed lactic acid or "soured" to a point where the least formation of curd begins can not be separated successfully, as the curd clogs the separator. Thus it will be readily seen that the milk delivered to the creamery must be sweet—that means that the operator has a much better quality of raw material to work on. He has control of the product from the time it is delivered fresh and sweet, whereas under the old plan he is compelled to accept cream gathered from the farmer's back porch where it has been held, perhaps for several days, and in many cases very carelessly treated, reaching the factory in all ages and stages of condition, much of it overripe and far beyond the operator's control.

Under the new plan he had a supply of fresh, sweet cream and absolute control of the ripening process and if he failed to turn out a high-grade butter the fault was his own. This type of butter-making plant became known as the "whole-milk creamery."

COMBINED CHURN AND BUTTERWORKER—Scientific mechanical invention was next called upon to improve the method of converting cream into butter, as it was necessary with the plain box churn and the table worker, previously described, to handle and work the butter in the open room subject to air temperatures and impurities, flies, and flying particles of dirt and more or less contact with the operator's hands. This necessity brought into existence the combined churn and butterworker (1893). In this machine the cream is churned, buttermilk drawn off, the butter

rinsed and the salt added, after which the "working process" is completed, all inside one wooden drum or cylindrical shaped churn with the mechanism for working the butter installed inside and operated by machinery. After the working process is finished the butter is removed with sterilized wood paddles, packed in standard



Cherry Power Churn.

Courtesy of J. G. Cherry Co., Cedar Rapids, Iowa.

containers with wood packers or tampers. The wood used in constructing the churns and containers must be odorless and of a very high grade, selected quality.

BUTTER CARTONS—Following this the necessity of marketing butter in small, retail packages of sufficient weight, neat in appearance, and for easy handling on the part of the retailers brought into use the so-called one pound printing device¹ a crude



Butter Carton.

Courtesy of J. G. Cherry Co., Cedar Rapids, Iowa.

affair, operated by hand one pound at a time and as the demand for this style of retail package steadily grew, butter-cutting machines developed step by step until in place of the one-pound

¹ A. H. Reid, "Lafayette butter printer," invented in 1892.

molding device above mentioned that turned out a few dozen prints a day, we have immense capacity machines cutting hundreds of thousands of pounds daily in the large buttermaking plants throughout the country.¹

FEEDING SKIM MILK—HAND SEPARATOR—The next problem confronting scientific minds in this great enterprise was the feeding of skim milk on the farm. It was found that during most of the year at least, milk having been thoroughly mixed and warmed to the necessary temperature for proper separation, would become sour by the time it was ready for feeding to the growing calves and pigs.

A thorough study of the various foods and their relative nutritious values is necessary in order to appreciate that angle of the dairy cow's value to the farm. Milk is an absolutely indispensable article in the dairy menu of young animals of every kind. It is as necessary for the growth of calves and pigs as for the growth of boys and girls, and the world is rapidly awakening to the realization of the fact that it is necessary to the mental as well as physical health, growth, development, and welfare of the human race as sunshine and rain to plant life.

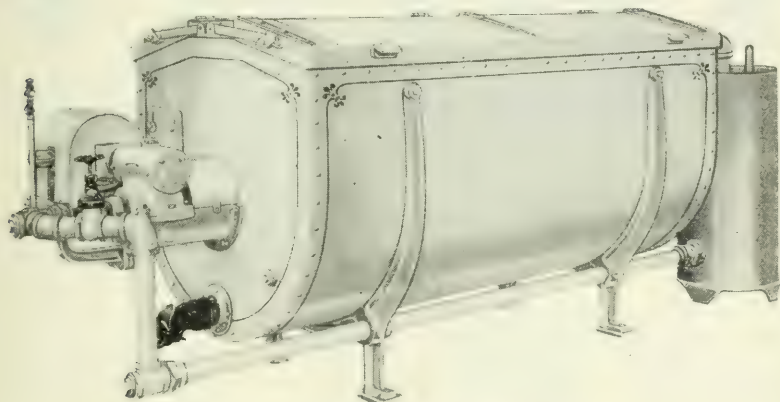
Science discovered that the greatest food value in milk exists at the time mother nature intended the young should have it, namely, while it still contained the animal heat fresh from the body of the mother animal—whether of the same species or otherwise. Skim milk coming back from the creamery had been robbed of this very important quality. The quick answer to this great and serious problem was the hand or farm separator (1895). The introduction of this invention met with a warm welcome and the demand grew with marvelous rapidity. By this time the dairy cow had come into her own. Many hundreds of farms that were badly "run down," on account of the exhaustion of the fertility of the soil through repeated crops of small grain, were converted to dairy farms and in a very brief time the acreage value materially increased.

The dairy cow became recognized as the only thing on any farm that returned to the soil many times what she ever took away. Worn-out lands were reclaimed in a short time to more than their previous highest value, while supplying most of the sustenance for

¹ Friday butter cutter, invented in 1902.

the great profit paying milk cow, pigs, calves, and chickens raised to a high market value almost exclusively on what is left from the product of the dairy cow after her owner has cashed in on her principal contribution to his profits—butterfat.

The hand separator revolutionized the creamery or buttermaking industry. Instead of hauling the wagonload of milk in ten-gallon railroad cans to the creamery every morning, the dairy farmer may now draw the milk from the cows twice daily, separate it as fast as it is milked, and feed the skim milk, still warm, fresh, and sweet, to the healthy, flourishing, young calves and pigs.



Cherry Pasteurizing Vat.

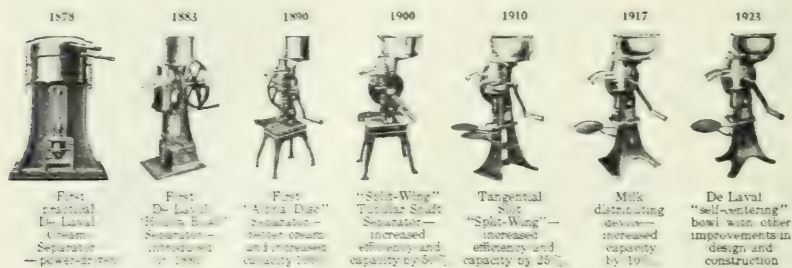
Courtesy of J. G. Cherry Co., Cedar Rapids, Iowa.

Then he carefully cools the cream in patented, cream-cooling tanks, scientifically designed and constructed by master mechanical minds, in the machinery branch of this great and glorious industry, keeps it sweet, free from contact with bad atmosphere, free of undesirable odors, and delivers it about every other day to the creamery or a shipping station maintained by the concern that buys his product.

Machinery has decreased his labor, saved him many hours of valuable time, materially reduced his expense, multiplied his profits in many different ways, and greatly increased the production of milk.

CREAM SEPARATOR—The mechanical process of separating cream from the milk is very simple in principle, yet interesting. It is accomplished by centrifugal force. The milk enter

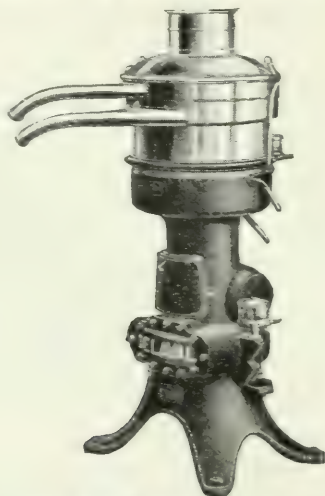
ing a bowl revolving at a very high speed, sometimes as high as 6,000 to 7,500 revolutions a minute, is thrown with great force to the wall of the revolving bowl, foreign particles that are heavier than any of the natural ingredients of the milk are thrown to the extreme outside and held, which constitutes a clarifying or cleaning process. Tubes fitted into the upper part or neck of the bowl



De Laval Cream Separators.

Courtesy of De Laval Separator Co., New York, N. Y.

are adjusted so that the cream with its butterfat content being lighter than any other ingredient escapes through an adjustable tube so placed that it permits only the cream to escape while the rest of the product, known as skim milk, is permitted to flow through another tube and a separate spout into a receptacle provided therefor.

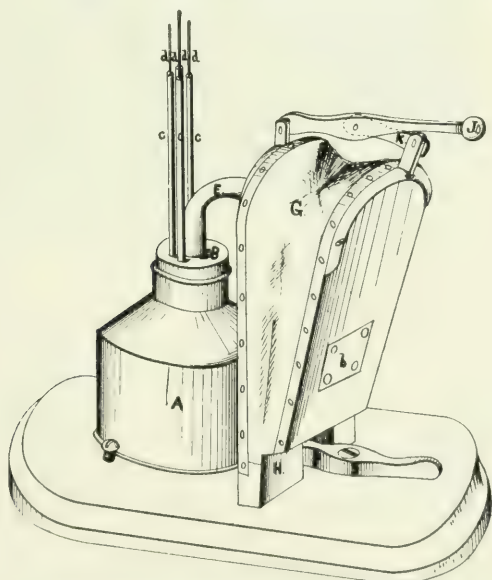


De Laval Cream Separator.

Courtesy of De Laval Separator Co., New York, N. Y.

This device takes practically the entire butterfat out of the milk and its adjustment permits the operator to control the separation so that it is possible to produce cream of varied butterfat percentage, or "richness," as it is commonly termed. The percentage of butterfat in milk depends upon the cow. The percentage of butterfat in cream depends upon the separator.

MILKING MACHINE—Now the dairyman is confronted with another vexing problem, that of milking the cows. Farm help is scarce and no farm hand likes to milk. He prefers to feed the hogs, curry the horses, and in fact any other kind of "chores" to milking the cows. This is the result of an unjustified prejudice, as once a farm hand becomes accustomed to milking he finds it a much more comfortable job than the other work about the farm buildings. Nevertheless, he has an ingrowing dislike for milking; therefore, mechanical invention must again be called upon to

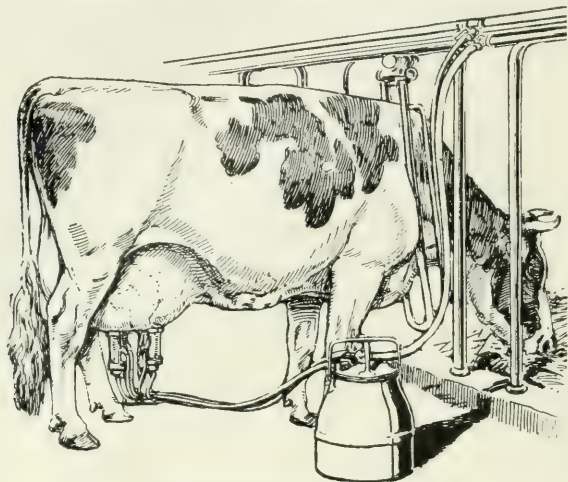


One of the First Milking Machines.

save the day. Unless the farmer can be provided with means for milking the cows he can not be encouraged to increase his herd, and in many cases he is tempted to decrease it.

In answer to this problem the power-milking machine, truly

a wonderful invention, almost human in its action, easy to operate, sanitary—the dairy cow, a highly nervous animal at best, does not object to it, and one man can look after the milking of



A Modern Milking Machine.

Courtesy of De Laval Separator Co., New York, N. Y.

6 or 8 cows at a time. Each machine, I believe, will milk 4 cows and one man can operate two machines and milk the cows in about half the time he could milk one by hand.

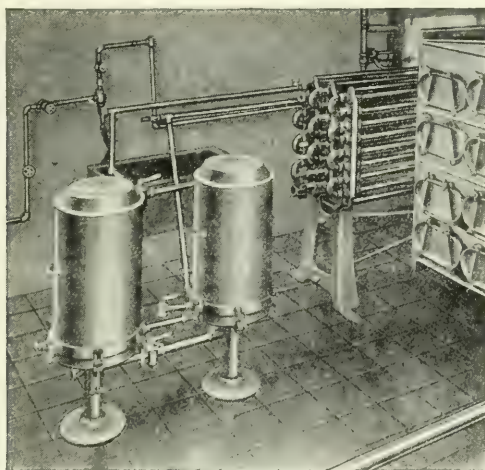
The hand separator and the milking machine have simplified dairy farming to an almost incredible degree. However, the whole-milk creamery is today almost extinct¹ and, owing to the possibilities of the hand separator, butter is now manufactured on a very much larger scale in what is called centralizing plants. The cream is separated on the farm, delivered at buying stations on the railroads and shipped to the churning or centralizing plant perhaps 100 miles distant, where it is made into butter on a large scale, hundreds of thousands of pounds daily in many cities throughout the country.

This latter change in methods and general plan of creamery butter manufacture brings into existence still more and many varied problems of a serious nature.

PASTEURIZATION AND REFRIGERATION—Cream coming in large quantities from the farmer direct or from the shipping

¹ About 5 per cent of the creamery butter is made in whole milk creameries.

stations previously referred to, encounter conditions in handling in all kinds of weather, delays in transportation, etc., that demand the application of modern science to protect its quality. It is well cared for on the farms owing to the scientific educational work carried on by our very efficient State experiment stations and dairy schools, but in the hands of the transportation company it can not possibly meet with the care and attention that it has received before leaving the farm.



Sanitary Milk Filters.

Courtesy of D. H. Burrell & Co., Little Falls, N. Y.

Creamery butter has come into universal use and its quality must be of the best; therefore, cream which has arrived at the centralizing station in an overripe condition must be taken care of. Mechanical refrigeration (1875) enabling the operator to entirely control the temperature of his product after it reaches the plant, plays a very large and important part in this highly necessary and vital angle of its treatment.

Large, mechanical-refrigeration installations providing capacity equal to the melting of many tons of ice a day, are to be found in all the modern creamery and milk plants of the present time. Cream upon its arrival at the factory at too high a temperature can be cooled immediately to the desired point, enabling the operator to exercise control from there on, and the most important of all

mechanical inventions for the modern (1895) handling of cream and the manufacture of butter is pasteurizing machinery—coil vats with heavily insulated bodies or walls and revolving tubular coils which keep the cream in motion and at the same time enabling the operator to change the temperature with great rapidity, are used in pasteurizing and storing cream in advance of its passing to the churn; this process of pasteurization destroys all the objectionable bacteria and restores overripe cream to its original pure and satisfactory condition.

When the process of pasteurization has been concluded, machinery for the preparation of a pure culture starter made from sweet, fresh, whole milk, provides for the inoculation of the cream with the finest, most healthful flavor-producing qualities and the cream is then brought to the most desirable condition for churning and converting into perfectly sweet, wholesome, and palatable butter.

After the finished product is completed, mechanical refrigeration again comes into active play, enabling the operator to store his butter at a temperature that insures its perfect keeping qualities indefinitely.

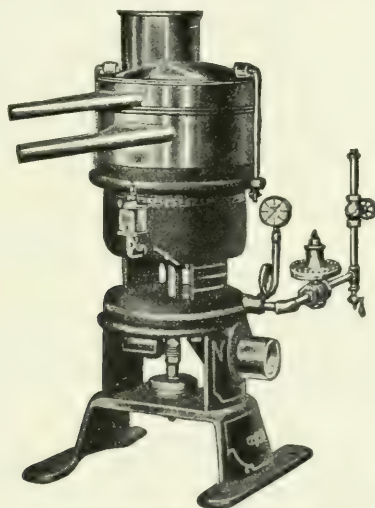
Artificial-ice-making machinery also plays a very important part in this practice as the demand for refrigeration of this kind has far exceeded the possible supply of natural ice throughout the country.

PARAFFINE AND PARCHMENT PAPER—Science has disclosed the fact that butter containers made of wood can be improved greatly by the application of paraffine and use of parchment paper liners. Machines have come into use during recent years with which a butter tub or box can be treated to a steaming process and then a spray of pure, melted paraffine supplied while the tub is hot. This cools, forming a sealing coat, inside the tub or box, of great value not only in protecting the product from absorbing any impurities but in retaining its flavor and in preventing the evaporation of moisture, a certain amount of which is vitally necessary in the best quality of butter.

RETAIL MILK AND CREAM—In the early part of this article is mentioned the manner of distributing milk in the cities in the old days, the dairyman milking a few cows and peddling his

milk in any old can with very little regard to careful washing and never any thought of sterilization, pouring the milk from measuring cans into such receptacles, as the housewife may choose, and no one bothering his head in the least about sanitary conditions or clean milk.

CLARIFIER—Compare a mental picture of that situation with modern methods existing at the present time—fresh, clean, sweet milk taken from the dairy herd and delivered each morning to the pasteurizing plant in the country or shipped in refrigerated express cars designed and built for the special purpose to the large city plant where it is first carefully strained or filtered, after which it passes through the clarifier—a modern machine, an adaptation



Factory Cream Separator.

Courtesy of D. H. Burrell & Co., Little Falls, N. Y.

of the cream separator, functioning the same as the separator except that it does not separate the cream and milk and deliver them through separate spouts into different receptacles, but the centrifugal force and the special scientific construction of the bowl of the machine takes out of the milk all foreign particles, sediment, dust, etc., that, no matter how carefully the milk is handled, accumulates from its contact with the atmosphere. From this clari-

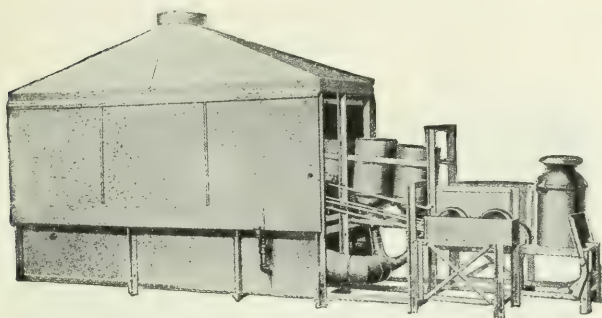
fying machine the milk passes over aerating equipment and thence into pasteurizing machinery (1906)¹ in a manner similar to that described as in the operation in a buttermaking plant. The pasteurizing process destroys all harmful bacteria and any disease germs that may find their way into the milk through contact with the atmosphere or handling. After pasteurization the milk is immediately cooled by means of the application of mechanical refrigeration to a temperature suitable for bottling and storing, as a result of which process the keeping quality of the milk is greatly improved and it is delivered to the consumer absolutely free of any undesirable bacteria, flavors, or odors. (Motor trucks first used 1915-20.

BOTTLING AND CAPPING MACHINES—From the cooling machine (1895) this milk passes to modern equipment for bottling, automatic in every detail. The bottle is filled (rotary filler first used 1910-15) accurately and then passes to another machine which mechanically applies the bottle cap. These bottle caps are paraffined and contained in tubes which are placed in the machine and from which the caps feed to the bottles in an automatic, mechanical manner and during the process they do not touch human hands—the caps themselves being sterilized in the manufacturing process.

If pasteurized and bottled in the country the bottled milk is then packed in shipping crates surrounded and covered with cracked ice in refrigerated cars and shipped to the distributing station in the city.

CAN AND BOTTLE WASHER—One of the most important things to be considered in the modern milk plant is the proper care of empty bottles and cans. (Can washer invented 1905). All the value of effort in pasteurizing milk and bringing it to the most desirable condition as to purity and quality in general would be wasted effort and entirely lost if the containers in which this milk is handled after pasteurizing are neglected. Therefore, bottle-washing machinery, one of the largest and most important items in the equipment of a modern milk plant, with enormous capacity, automatically handle bottles of the various sizes in crates of from 12 to 24 each, thoroughly cleanse and sterilize them during their

¹ Joseph Willman invented a regenerative pasteurizer in 1906



Milk Can Washer.

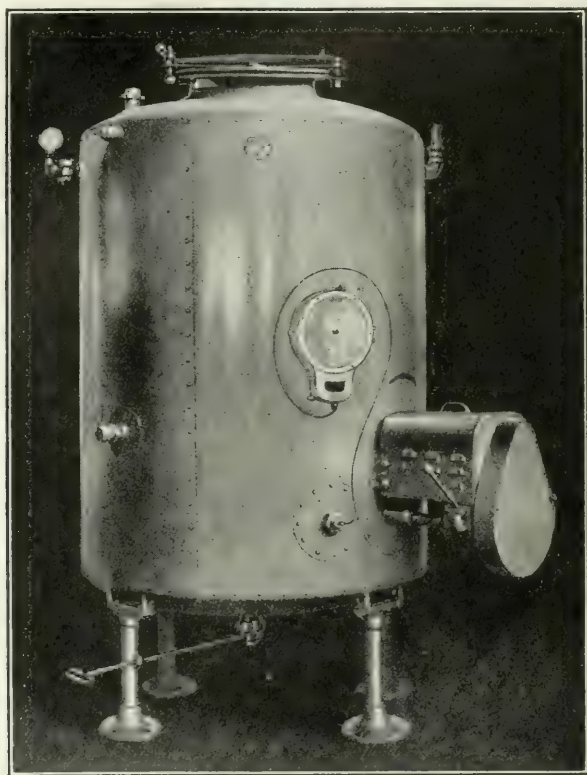
Courtesy of The Lathrop-Paulson Co., Chicago, Ill.

passage through the machine, by the application of water, cleansing powder, sterilized brushes, and steam. These machines have capacities as great as several thousand bottles per hour, and the same is true of cleansing milk cans. Similar machines are utilized and in the same manner as described above with capacities equal to the requirements of the largest milk plants in existence.

TEMPERATURE CONTROL—Temperature-controlling and registering instruments have proved of inestimable value in pasteurizing and handling of milk under control of the boards of health, state inspectors, etc. Recording thermometers working automatically under lock and key register the temperatures at which milk is pasteurized and held upon charts which are filed with the health officials in each city. Automatic temperature controllers protect this product against the dangers of unexpected and unintentional changes in temperature which could in any way affect the quality of the product or the benefits of the process. These things insure the public against the purchase of milk and cream in the large cities that is anything but safe for human consumption. The protection of quality in the city milk supply during the last very few years has reduced the infant mortality rate over 80 per cent. These things, as can readily be seen, would be absolutely impossible without the aid of modern machinery at every turn of the road. (Pasteurization begun in New York City, by Nathan Strauss, 1893.)

ICE CREAM—The wonderful development of this product during recent years is too well known to require any comment.

One small ice-cream concern in the city of Baltimore had in storage in the month of June, anticipating the Fourth of July rush, years ago, 32,000 gallons of ice cream.



Glass Lined Tank with Agitator.

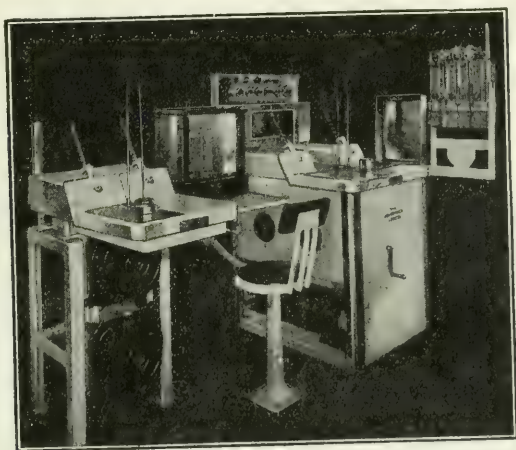
Courtesy of The Pfaudler Co., Rochester, N. Y.

Owing to the change in conditions throughout the country in the milk supply and principally the hand separator, it is plain to be seen that a supply of fresh, sweet cream from the farm is not available to the large cities in any such quantities as the popularity of this product demands. Therefore, we should not overlook the very important mechanical invention that enables the manufacturers of milk powder to convert whole or skim milk into powder by evaporating therefrom all the water, leaving in the milk every other ingredient and its full nutritious value which by the simple process of adding water in the same quantity that it originally

contained restores the product to what it formerly was, namely, skim milk or whole milk, as the case may be.

VISCOLIZER—Skim-milk powder is used to a very great extent and cream is prepared by an ingenious mechanical invention called a viscolizer which manufactures cream by the process of feeding water, milk powder, and fresh, pure butter in the proper relative percentage into a machine that applies tremendous pressure and produces a quality of cream that can not be distinguished from the original product. The advantages and the tremendous possibilities of this will be readily understood.

HARDENING ROOMS—Ice cream has become the most popular delicacy in the United States and the people at large are rapidly coming to realize its health-giving qualities. Enormous capacity plants are necessary to take care of this constantly grow-



Mojonnier Tester for Fat and Solids in Milk.

Courtesy of Mojonnier Bros. Co., Chicago, Ill.

ing demand. Modern machinery has enabled the manufacturer of ice cream to turn out thousands upon thousands of gallons a day with large-capacity, power ice-cream freezers, mixing vats of the coil type similar to the pasteurizing machines heretofore described, mechanical-refrigerated freezing rooms of unlimited capacities with temperature maintained below zero if desired.

Ingenious devices for testing ice cream to determine the amount

of its butterfat, the amount of overrun, or swell;¹ molds for forming the frozen product into attractive shapes and forms for serving, mechanical automatic machines for washing ice-cream cans of all sizes, shapes and styles and many other things go to make up the equipment used in developing this branch of the industry.

CONDENSED MILK—Here is a branch of the industry that involves the use of more ingenious devices, much more intricate, sensitive, and expensive mechanism than any other branch of dairying. The process of taking whole milk, which by the way must be delivered to the factory in perfect condition, that is, with no development of lactic acid of consequence), evaporating the water and preparing for many different grades of condensed and so-called evaporated milk for the market, is one of the most interesting processes about which there is very little known by the public at large. This milk after passing through its several different stages of preparation which involves the use of numerous inventions is delivered to a large, enclosed kettle or pan, as it is termed, where excessive heat is applied under vacuum and the moisture evaporated.

The intricate device utilized in exercising entire control over this product, which is all important in its successful manufacture, are of little interest to the public; therefore, we will mention particularly only the vacuum pan which is the principal invention used in the actual process, the mechanical cooling machines, sanitary pumps, storage tanks, sanitary pipe, and fittings through which the milk passes on its way to the machine devised for the purpose of filling the different-sized cans with condensed milk.

CAN FILLING MACHINE—This machine is very interesting indeed and differs quite materially from the machines used in the milk plants for bottling milk. The cans themselves are manufactured in the same plant and it is interesting to note that large sheets of tin plate delivered to some one point in this large factory pass with tremendous rapidity through the many stages of manufacture and are delivered in a continuous stream to the filling department. After being filled with milk another ingenious device is used to seal automatically the opening in the cans through which they are filled, as this product must not come in contact with the air after it is put into the cans.

¹ Mojonner overrun tester invented in 1918.

Then continuing on their way the cans encounter another machine, which is the automatic labeling device. The cans of milk in passing through this machine are wrapped with lithographed labels, packed in cases by machinery and are ready for the market.

A great many different grades of condensed milk are made from what is termed a superheated or sugared goods to the plain evaporated. These grades differ very materially in consistency.

CHEESE—In the development of the cheesemaking branch of dairying intricate mechanical contrivances and inventions have not played so active and important a part, perhaps, as in some of the other branches. Cheese has become a very staple and popular commodity in its many and varied kinds and has become recognized as a highly important, healthful, and profitable food product of equal importance to other commodities produced from milk.

Science, endless research, and experimentation have resulted in the production of rich, appetizing table delicacies of many kinds in the form of cheese, whereas, during the days of a crude process by which curd was squeezed into a solid mass and permitted to ripen or cure until it was called cheese. This product is now



Cutting and Stirring Curd with a Harp, Grove City Creamery, Pa.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

turned out in very large quantities and under a variation of brands innumerable—each and every one a little different in composition and taste.

VATS, CURD MILLS AND PRESSES—There is a very active demand for this commodity in all parts of the country and quality of American-made cheese is second to none in existence, but its development has brought into active play more of skill in process than in mechanical devices. Special styles of vats, large-capacity curd mills for grinding the curd in the manufacture of the heavier body cheese, large gang presses, and many other items in the necessary equipment for high-class work in this department are utilized until there is in existence every convenience for the manufacture of this product on a large scale, but modern machinery invention is not to be credited with so large a part in the development of this branch of the industry as in most any one of the others.

SUMMARY—In passing hastily over the foregoing sketch bearing upon the relation of mechanical invention to the dairy industry, we have neglected to draw attention to that most important matter which should be first considered in all such matters, the economic advantages offered by modern machinery in every branch of the industry.

Modern equipment has made it possible to turn out of one plant 100,000 pounds of butter daily, to pasteurize and bottle in another plant 200,000 quarts of milk in 7 hours, to produce and put into storage 2,000 gallons of ice cream in a day's run and to evaporate and seal in air-tight marketing cans, 500,000 pounds of milk in 10 hours. All this is accomplished at an expense that enables the manufacturer to pay the producers a high price for milk and to place it upon the market at a price within reach of every family and make a profit on his investment.

Saving of labor in the production of mechanical inventions for use in handling dairy products is its greatest accomplishment next to that of preparing the product for human consumption in a manner that insures its greatest health-giving and nourishing qualities and makes it absolutely safe for invalids and infants.

Without this machinery, without the close attention and scientific application of mechanics of all kinds to this industry,

its growth would have been impossible. If one-hundredth part of the milk and its products consumed in the United States today would supply the demand and that quantity had to be prepared by hand its cost would be prohibitive and its quality would not begin to compare with the product as it reaches our market.

Science, mechanical genius, skill, modern mechanical invention, and methods have, in my estimation, played the very largest and most important part in bringing the dairy industry to its present high standing. These changes could not have been accomplished by modern development of machinery alone, nor could any one or all of the other forces together have succeeded, even in a limited measure, without the tremendous progress made in developing and improving machinery. Very little would have been possible in development and progress of the dairy industry itself were it not for the efforts of those who have devoted the very best years of their lives to the invention, development, and improvement of dairy machinery.

BUTTER DEVELOPMENT—Within a few years after the Colonies were settled some of them were selling surplus butter. The New England States were first to market butter then New York, Ohio, Illinois, and Wisconsin, and reaching always to the west. The southern states on account of cotton growing did not take to the dairy industry to the same extent as the northern states. (The development of butter production is well covered under the chapter on Machinery—its place in the industry, page 73.)

METHODS OF BUTTERMAKING—The making of butter, as the making of cheese and the handling of milk and the milking of cows, has for centuries been the work of women and it is therefore, interesting to know how some of the women of various nationalities and races churned their butter. The following references are briefed from Mrs. Child's History of Women (1835):

ARABIAN WOMEN: "They put the milk into a goat skin with the hair all on. This is suspended by strong cords to the branch of a tree and a woman shakes it with all her might until the butter is produced. The skins are seldom washed and the butter, of course, is none of the sweetest. Butter is used very freely by this tribe (Kereks) and they consider it the highest of meanness to sell it. A 'butter-seller' is a most contemptuous epithet, and the daughter of such would have no chance to get a husband."

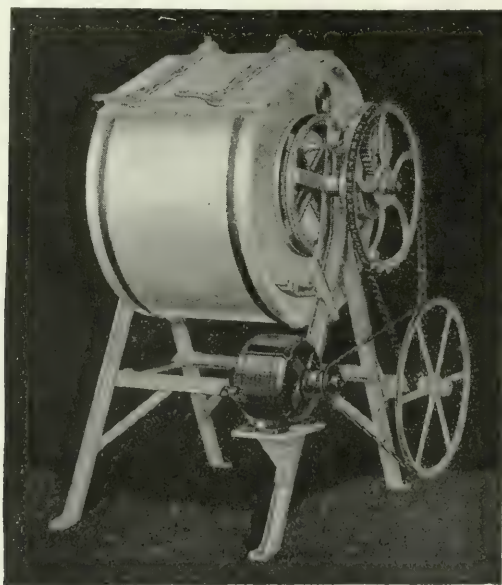
MOORISH WOMEN: "They make butter in goat skins exposed to the sun.

When the woman makes cheese she separates the curd from the whey with the flower of the great-headed thistle, or wild artichoke. As corpulent women are desired the daughters are compelled to drink large quantities of camel milk each day."

AFRICAN WOMEN (Soudan): "Make butter by stirring in a calabash, or shaking it in a skin as the Arabs do. Cheese is never made in the interior of Africa. They give as the reason for it, the heat, the climate and great scarcity of salt. A folklore story of these people states that 'the white man was produced by dipping in milk when an infant.'"

SCYTHIANS: "The Scythians produced butter by shaking it in a jar."

It is not recorded, so far as we could find, how the people of India of the early times churned their butter, except that they churned the whole milk, however, the first three people who visited that land and returned to write their story, in the 15th century,¹ tell of tame elephants, priests, and wealthy people having plenty of butter or ghee to eat with their rice.



Barrel Churn.

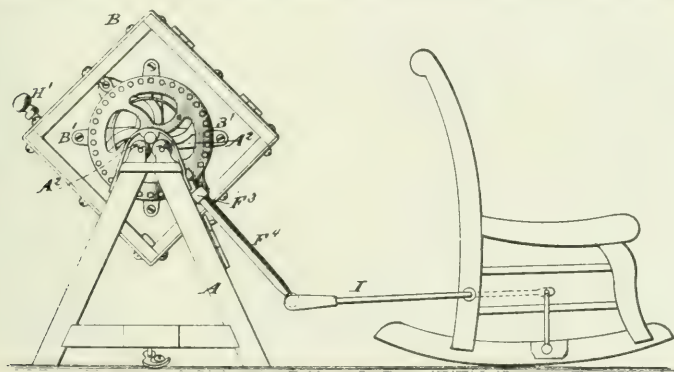
Courtesy of J. G. Cherry Co., Cedar Rapids, Iowa.

UNITED STATES PROGRESS—The first butter made in this country was probably made by the use of the old style dash churn and made on farms, however, the barrel churn had been in use

¹ India in the 15th Century, by Richard Henry Major (1857).

for years even before America was settled. The making of the butter on farms continued until about the year 1860, when the factory system rapidly replaced farm buttermaking. In 1925 there was still nearly 600 million pounds of farm butter made, however, it was mostly consumed on the farms where made.

Soon after the factory system began the large box churn was invented and increased the speed of churning, that is, increased the quantity which could be churned at one time. Major Alvord calls attention to the inventive effort to produce churns and says that soon after the Revolutionary War there began a continuous effort to improve churns and the U. S. Patent Office had records showing that a new churn or improvement was produced every two weeks for more than 70 years, and apparently every device was suggested.



Churn Attached to Rocker.

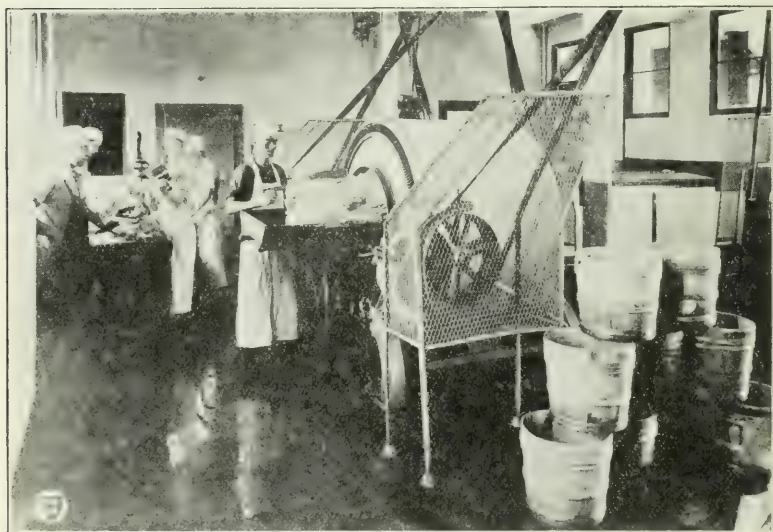
It is claimed that no effort was made to attach a churn to the baby's cradle but nothing else escaped not even grandma's rocker.

The greatest improvement in churns carried three points, economy, volume, and efficiency in sanitation, speed, and clean churning. This was all accomplished in the combined churn and butterworker invented by Disbrow in 1890. The largest of these churns made 1,000 to 1,500 pounds of butter in an hour and thus greatly increased the capacity of each factory. Prof. Conn of Storrs, Connecticut, in 1889-90 developed bacteria for butter cultures (starter) to improve the flavor of the butter especially butter made from pasteurized cream.

Most of the butter in the United States is of medium grade and, therefore, not well adapted for export trade, however, there

is a great deal of fine quality butter (92 score or better) being made and the quantity is increasing, especially since the advent of sweet cream butter. Many creameries are being built in dairy sections for the purpose of making sweet cream butter. Milk plants, cheese factories, and condenseries also have excellent milk furnished their plants and surplus may be made into sweet cream butter.

Sweet cream buttermaking was developed in the Bureau of



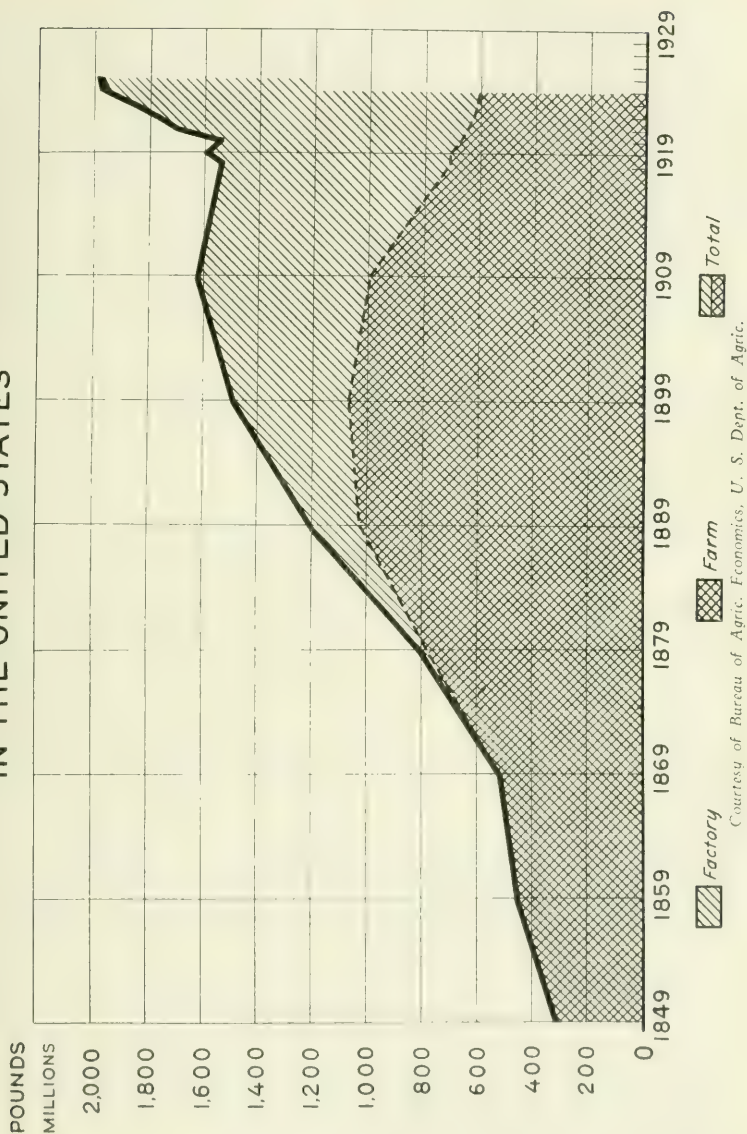
Buttermakers at Work, Grove City Creamery, Pa.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

Dairy Industry in 1905 for the purpose of securing for the U. S. Navy butter which could be transported to sea without serious deterioration. At first it was packed in 3 pound and 5 pound cans and stored in cold storage warehouses. This butter was found to keep much better than the sour cream butter.

FARM BUTTER—The total production of farm butter in 1925 was only about one-third of the total butter produced in the country. The production of farm butter has decreased rapidly ever since the introduction of the creamery. Most of the butter is used on the farms but some is sold locally and a part eventually finds its way to the market as "packing stock" which is again sold for use in the manufacture of renovated butter. Renovated butter

TOTAL PRODUCTION OF FARM AND FACTORY BUTTER IN THE UNITED STATES



is of poor quality but the quantity made is small as only 7 factories were in operation during the past year.

Farm butter does not affect the price of creamery butter on the large markets and does not enter foreign trade.

GROWTH OF CREAMERY BUTTER INDUSTRY—The first creamery butter production reported by the United States Census was for the year 1879 and showed 29 million pounds made during the year, in 1889 it was 181 million pounds, in 1899 421 million and reached a billion pounds in 1921. In 1925 the production of creamery butter was 1,361,526,000 pounds. This is a very large amount but all is needed within the country.

RESUME OF METHODS — A brief resume of the methods used, or attempted, in the manufacture of butter may include the following:

1. Farm buttermaking up to 1860.
2. Whole milk creameries—"shallow pans" or "Cooley system."
3. Gathered cream creameries, gravity system.
4. Whole milk creameries, cream separated by centrifugal separator at factory.
5. Moving creamery—creamery on wheels moving from farm to farm.
6. Moving cream separators from farm to farm.
7. Gathered cream creameries, farm separators used.
8. Centralizer system used, cream shipped by rail to central factory.
9. Sweet-cream butter creamery—sweet cream received daily and churned sweet.

CHEESE INDUSTRY EXPANSION—Cheesemaking in the United States has been relatively important since the earliest settlements in the Colonies but was a farm enterprise until 1850. It is true that there was a stir in the country looking toward the use of factories for cheesemaking before that time. (Possibly the first cheese factory, according to present standards, was built in Bern, Switzerland, by R. V. Effinger in 1815, but the fact was scarcely known outside of the province.)

In the United States there are several claims of priority. The first cheese factory in Wisconsin was built in 1831 by Charles Rockwell of Koshkonong, also Mr. A. Pickett of Lake Mills, Wis., started a cheese factory June 1, 1841. He had 10 cows and rented 10 others from his neighbors. The patrons took cheese at the end of the season instead of money.

The cheese factories first built in Ohio were really curd factories, that is, the curd was made on the farms and hauled to the factories where the remainder of the process of manufacture was completed. Quite a number of these curd factories were built by

Dow and Howard. In 1852 there were erected great curing houses which was also a step toward factory methods, as it took much of the labor away from the farms and thus gave the industry new life.

The first factory built in New York State was built by Jesse Williams at Rome, N. Y., in connection with his son. Mr. Williams was under contract to furnish cheese from the milk of his cows and those of his son who lived near him. He considered it poor business to make two batches of cheese, one at his place, and the other at his son's place, therefore, he built a small factory. He began working on the subject about 1851 and the factory was built in 1852. This factory was the first one advertised and used as a sample for the construction of other factories.

Further encouragement appeared at this time by the advent of tin utensils, tin vats, etc. Then came the war (1861-1864) which practically stopped all progress in the cheesemaking industry and when it was reorganized it was under the factory system.

The first wholesale buying of cheese of record was by Harry Burrell of Salesbury, N. Y., who began buying cheese in 1826 and about the year 1830 opened a regular trade with England shipping 10,000 pounds that year. The first cheese was boxed in 1841 and the curd mill and Cheddar process were introduced into Herkimer County, N. Y., by Robert McAdam about this period and were soon largely adopted.

FROM FARM TO FACTORY—According to Alvord the change from farm cheesemaking to factory was very rapid, in fact the change and the development that followed was such that within two decades the "States" cheese had its highest reputation and the export trade was the largest the country has ever known. He said:

"Prior to 1850 all of the cheese of this country was made on the farms where the milk for it was produced; it was simply an article of domestic manufacture. About the year 1860 the cheese factory came into vogue as an improved and economical system for cheesemaking. Wherever the idea may have originated, it was first fixed upon the public mind and developed in the county of Oneida, N. Y. Once established the advantages of the associated method became manifest, and the spread of the 'American' or 'Factory' system was very rapid. So much so that in 1869 two-thirds of the cheese of the country was made in factories. The proportion of cheese now made on farms is insignificant, com-

pared with that made in factories." (Written in 1895, U. S. Dept. Agric. Yearbook.)

Up to the year 1895 there were few foreign types of cheese made, although a little Edam, Gruyere, Pineapple, and Limburger had been made for years.

The cheesemaking industry began in New York State and for years that State held the first place both in quantity of cheese produced and in the quality of cheese, however, the State of Wisconsin rose to an equal position in 1878, just when the foreign trade was at its best, and held that position for a few years.

BOARDS OF TRADE OR CALL BOARDS—During this period of popularity and development the cheese industry flourished. Dairy Boards of trade were established, the first one in 1871, at Little Falls, N. Y., with sales beginning May 1, 1871. Hon. X. A. Willard was the leading spirit. Cheese was sold on these boards instead of by contracts at factories as previously. Prices were posted in plain sight and the factorymen were as well informed as the buyers. A number of boards were soon established at cheese centers. The Utica, N. Y., board was one of the first and possibly the largest for years, but later the Wisconsin cheese boards were organized and handle much larger quantities of cheese, namely, the Plymouth and Sheboygan boards.

About the year 1880, the cheese industry was most popular. Foreign countries had buyers located in the great markets to secure the best cheese. New York alone had 40 buyers. Canada, Germany, the United Kingdom and our own Southern States were heavy buyers and consumers of American cheese.

LOSS OF A GREAT TRADE—The export trade in cheese had been built up from 15 million pounds in 1860 to 148 million in 1881, increasing nearly ten times. Then the exports began to decrease and within three decades were really negligible. The great trade had been lost, but not through decreased production.

During the period from 1880 to 1895 there was not only a loss in the export business but the price of cheese fell to 9.5 cents a pound which helped to discourage the producers. Skim cheese and filled cheese had entered into the trade generally under the guise of genuine cheese. The skim cheese had a large per cent of

the fat removed while the filled, "oleo cheese," cheese was made from skim milk to which lard was added to replace the butterfat which had been removed. The cheese looked well for a time and then deteriorated very fast but never had the flavor of a good cheese. A statement is given by Alvord (1895) as to the origin of these cheeses:

SKIM CHEESE: "It is impossible to determine exactly how and when some American factories, organized with the sole purpose of making wholemilk cheese, began to manufacture skim cheese and to add buttermaking to their other work. It seems, however, to have resulted gradually from a combination of natural and economic causes beginning soon after the factories became numerous. Thus late in the season when milk diminished in weight, grew rich and kept longer, patrons at a distance from the factory would deliver only every other day and the cream having separated in the earlier messes they would remove for home use and send to the factory milk with but half or third of its cream. * * * Frugal managers discovered that they could turn out as many or more pounds of both butter and cheese from a given quantity of milk as a cheese alone and could sell the double product for more than the single one. The skim cheese was mostly flat in flavor, hard and horny. * * * The better class of part skim cheese was unscrupulously sold while at their best for the genuine full cream article. The general reputation of American cheese at home and abroad has necessarily suffered in consequence."

Wisconsin passed a law prohibiting filled cheese and part skim cheese manufacture in the State in 1895. However, the manufacture has continued in other states.

FILLED CHEESE—(Oleo cheese)—Soon after the invention of Oleomargarine, (1870) the process was also applied to cheese and lard was generally used instead of butterfat in making the cheese, which was generally sold as genuine cheese. Filled cheese was made in New York as early as 1880 and several patents of the process were taken out and by 1884 a lucrative business was carried on by a few who had adopted the scheme. In 1884 New York created a dairy commissioner and passed some stringent laws against its manufacture. The men who owned the patents conformed to the laws and New York has been clear of filled cheese ever since, but two or three years later the Illinois and Wisconsin factories took up the manufacture and made very large quantities of the so-called cheese. "The result has been disastrous to the cheese trade of the whole United States." (Alvord)

When the filled cheese was first sent abroad it was not recog-

nized and when consumed quickly it was hard to distinguish from real cheese, but when held a short time it deteriorated and showed its true nature and caused a loss to buyers.

CAUSES FOR LOSS OF TRADE—Fifteen years after the export trade began to decrease the Department of Agriculture gave the following reasons:

"1. Restrictions placed upon the freedom of trade between the United States and Canada; 2. Energy and success of the Canadian Government in developing and improving the cheese of the Dominion; 3. The short-sighted policy of the cheesemakers in turning out poor quality and ignoring the tastes of the consumers; 4. The exportation of too much low grade cheese, "skim" and adulterated, in defiance of the requirements of British markets and the consequent degradation of a well-earned reputation."

The following solemn declaration from the Secretary of Agriculture came after much of the damage was done:

"No one can pursue the above facts and figures without arriving at the conclusion that unless our shippers of cheese pursue a very different course, the history of our foreign trade in that product will speedily fail, in the face of active, intelligent, and honest competition from all parts of the world, to the level now occupied by American butter. We have here a graphic illustration of the disastrous effect in all trades of disregarding the tastes of consumers and of degradation of a well earned reputation.

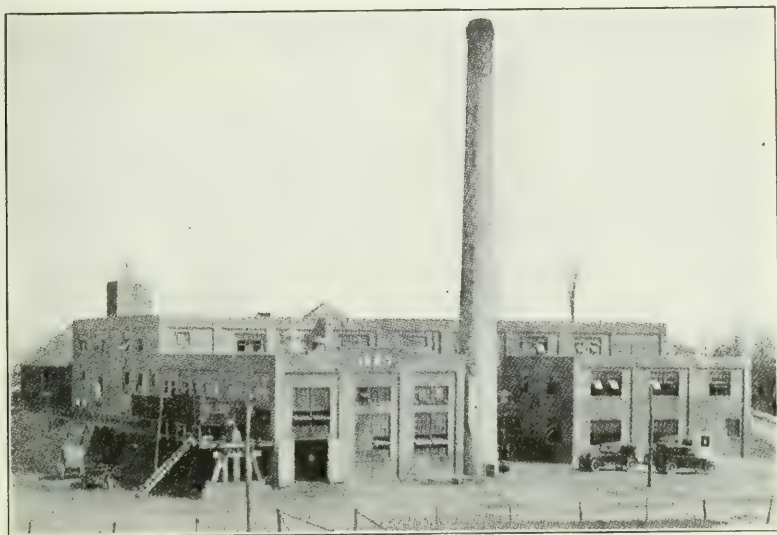
Filled cheese was made and exported up to 1912 when the business died for want of buyers.

1880 TO 1926—During this period the cheese industry extended west to the Pacific Coast seeking out specially fine locations and keeping away from the large cities and their competition for the milk. New York has largely changed from butter to cheese and then to market milk, although some cheese factories are maintained and condenseries are retaining a foothold as well, still the big business of the State is the production of market milk.

Wisconsin forged ahead in the production of cheese, the cheese districts of that State are quite distinct from the butter districts, but it appears that the cheese industry has more and more become a locality development rather than a state or section. For instance, Tillamook County, Oregon, Dane County, Wisconsin, mountain sections of North Carolina, and Tennessee. California and Michigan each have prominent cheese sections while most of the Swiss cheese is made in Wisconsin and Ohio. Wisconsin in 1925 pro-

duced nearly 70 per cent of all the cheese made in the country. It is Cheddar cheese, in various types, Swiss cheese, brick, munster, Limburger, some Italian varieties and a little full skim cheese.

Some of the cheese companies have acquired enviable reputations for their cheese and have built up an immense business. The following shows the progress of the Phenix Cheese Co., of New York, which appears simply to have followed good business practice and made good cheese.¹



New Eastern Home of "Philadelphia" Brand Cream Cheese, South Edmeston, N. Y., the Largest and Finest Equipped Cheese Factory in the World.

"In 1880 Alvah L. Reynolds established a cheese business in New York City. He acquired a wagon and made store-to-store delivery of cheeses. So far as we know, this was the first time that a business devoted exclusively to cheese had been handled in this manner in New York. The business increased and by 1890 he was operating 15 wagons in the metropolitan district. In the meantime (1885) a factory was built at South Edmeston, N. Y., where cheese was manufactured and shipped to the distributing organization in New York City.

"In 1892 a wholesale warehouse was operated in connection with the store delivery under the name of A. L. and J. J. Reynolds.

"Fancy package cheese were made and sold, such as: De Brie, D'Isigny, Neufchatel, and the famous brand known as 'Philadelphia' cream cheese, from 1885 until late in 1900, when the factory was burnt down and abandoned by A. L. Reynolds.

¹ The quotation was written especially for this book by the Phenix Cheese Co.



Kinds and Types of Cheese Made by the Phenix Cheese Company.
Courtesy of the Phenix Cheese Co., New York, N. Y.

"In order to preserve an important market for their milk, the farmers of the neighborhood formed a corporation known as the Phenix Cheese Company and rebuilt the factory. The company was successful from the time the factory was completed and in 1903 it purchased the New York City business and began a history of marvelous growth. The Phenix Cheese Company continued the Reynolds policy of developing the trade in package cheese so successfully that it was obliged to acquire other factories in New York State, at West Exeter, Leonardsville, River Forks, and Cedarville. Then the trend westward for a greater supply of milk began for the manufacture of cheese; as the growth of the eastern cities required an ever increasing share of the milk produced in New York State. Consequently the company purchased a plant at Zeeland, Mich., in 1910 and continued to operate it until 1924 when the supply of milk became inadequate. Plants were also secured in Wisconsin at Beaver Dam, Birnamwood, Plymouth, and Monroe; in Canada at Montreal, and in California at San Francisco.

"The increased business required branch offices and warehouses to be established at Portland, Me., Boston, Philadelphia, Pittsburgh, Chicago, San Francisco and Los Angeles. A branch office has also been established in London. From Montreal shipments of cheese are made to Japan, South America, Europe and other parts of the world.

"Recently an advertising campaign was undertaken with the result that sales have increased to 30 times what they were in 1903. This increase in sales and the growing popularity of the package is in line with this method of handling other products in packages.

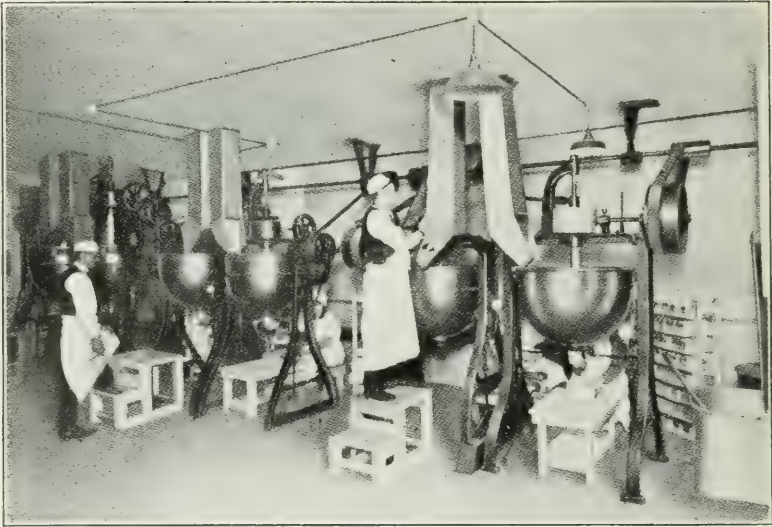
"Early in 1903 the Phenix Company began the manufacture of Swiss (Emmenthal) cheese. Attention was given to the size and distribution of the holes (following the recent developments along that line in the U. S. Department of Agriculture) with good success.

"Philadelphia Cream Cheese, manufactured by this company, has been the leading brand for this type of cheese for many years. In accordance with the policy to make this cheese in as sanitary a manner as possible, it has been made since 1912 from pasteurized cream and since 1915 it has been moulded and wrapped by machinery patented by the company.

"Following the trend of the best products companies, the Phenix Cheese Company have adopted mechanical devices for moulding and wrapping club cheese, five pound loaf, half pound and quarter pound. The package cheeses cover the following kinds: American, Pimento, Swiss, Limburger, Brick, Muenster, Old Sharp, Roquefort, American and Mustard Swiss.

"Pasteurized or Club cheese is also packed in "tins" in 3½ ounce and 6 ounce sizes. Sealed in tins the cheese keeps indefinitely without refrigeration. Pasteurized cheese is also wrapped in tinfoil in convenient sizes. The attractive character of the package, the lack of waste due to the absence of the rind, and the ease with which it can be handled and sold have caused a rapid increase in the tonnage manufactured.

"Before the war Camembert cheese was chiefly imported but during the war exportation from France was prohibited. Fortunately the Phenix Cheese Com-



Where Club Cheese is Manufactured by the Phenix Cheese Company.

pany had been manufacturing Camembert cheese for several years under the name of 'Castle Brand.' Therefore, during the war this product was sold in large quantities and became firmly established in this country and now only a small quantity is imported.

"In 1924 the Phenix Company was reorganized under the name of Phenix Cheese Corporation."

PROCESSED OR PACKAGE CHEESE—The development of the process or package cheese business is one of the outstanding accomplishments of the cheese industry in recent years, in fact the cheese industry of the United States has been slow and uncertain in most of its past history. There has been an occasional effort to "can" cheese and a number of bulletins have been written on the subject, but each admitted defeat for the project, however, the unattainable is most alluring. When success for package cheese finally appeared it was considered by many as the salvation of the industry.

The pioneer in the present processed cheese business was J. L. Kraft, who after studying the subject for several years finally perfected his process sufficient to start a business which has exceeded his highest expectations.



In 1904 J. L. Kraft, the present head of the company, left a retail store where he had been a clerk and started in business in Chi-

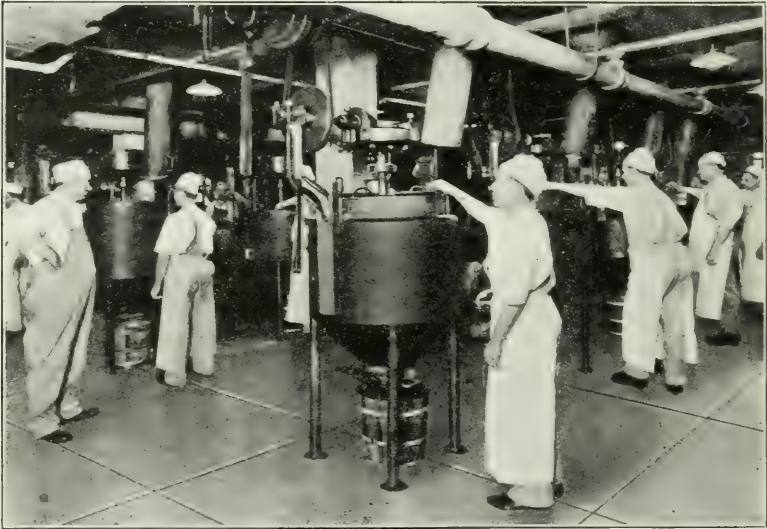


Filling Pasteurized Kraft Cheese into 5-lb. Foil Lined Wood Boxes.

Courtesy of the Kraft Cheese Co., Chicago, Ill

cago with a capital of \$65. He peddled cheese to grocers with a one-horse wagon. By 1917 he had developed a business that amounted to a half million dollars in sales a year, and the company was incorporated for \$25,000. The business continued to prosper and in 1919 the sales were more than \$2,000,000. In 1920 they were \$4,225,000, in 1922 the sales were a little more than \$11,000,000, in 1923 \$18,290,000, 1924, \$23,750,000, and for the year ended March 31, 1925, the sales were \$31,097,000.

The company was re-incorporated in 1925 for \$10,000,000.



Pasteurizing Room of the Kraft Cheese Company. A Battery of 69 Kettles, Each Attended by an Expert Cheesemaker.

Courtesy of the Kraft Cheese Co., Chicago, Ill.

This company has been a heavy advertiser and is convinced that by the use of colored advertisements the business was doubled in two years. Not all of the business success is attributable to the advertising, as the goods have desirable qualities, such as, sanitary handling, convenient packages and uniformity of quality. Mass production is accompanied by mass selling. The advertising was directed toward education on the subject of nutritive value of cheese and the sanitary package.

It is claimed that 85 per cent of the grocery and delicatessen stores in this country handle the processed cheese and that possibly

25 per cent of all cheese made in the country is afterwards processed and retailed as package cheese.

The process as used by all the process manufacturers, and there are several of them including Pabst, Kraft, and the Phenix Co., is essentially the assorting of cheese, grinding and pasteurizing the mixture, and while the plastic cheese is hot it is dropped into the final foil-lined containers and sealed white hot. The processed



**Laboratory of Kraft Cheese Company. Largest Laboratory in the World
Devoted Exclusively to Cheese Research.**

Courtesy of the Kraft Cheese Co., Chicago, Ill.

cheeses are mostly sold in the 5-pound loaf, although there are many sized packages being produced. The blended cheeses include Limburger, Camembert, and Roquefort while the Swiss loaf is one of the most popular sellers.

COOPERATIVE SELLING ORGANIZATIONS—This phase in the development of dairying has been discussed under “Cooperation” but is mentioned here only because it is one of the greatest steps in the cheese industry and because it is still one of the potent factors being developed at the present time. (See page 155.)

COLD CURING OF CHEESE—A number of the dairy schools and experiment stations became interested in the effect of temperatures on the curing of cheese about the year 1898. Geo.

A. Smith¹ of New York showed from experiments that cheese cured at 60° F. scored 5 points higher than that stored at 65° F. and this was followed by Russell and Babcock, Wisconsin, in 1902,² with experiments showing that a temperature below 60° F. was better than above that temperature but that such curing required more time and expense. Doane, in 1906,³ U. S. Dairy Division, found similar results and also that the warehouses generally held their cheese at from 30° to 36° F. This subject was further tested with pasteurized-milk cheese at the Wisconsin Station by Sammis and Bruhn⁴ who found that with pasteurized-milk cheese the curing could be done at 70° F. without injury and could be placed into storage at 34° F. after one week. These findings paved the way for pasteurized-milk cheese and again emphasized the importance of quality in milk for cheesemaking.

SWISS CHEESE MAKING—Among the early settlers of the state of Ohio were many Swiss emigrants who settled in the north-eastern part of the state and at once began the making of Swiss (Emmenthal) cheese. This Swiss cheese industry has continued in the same locality to this day. The same thing happened in Wisconsin when a large colony of Swiss emigrants settled in that state. These two regions now furnish the principal output of Swiss cheese for the country. The Swiss cheese production has never been very strong but has just about held even with the quantities imported from year to year. During the World War it was impossible for Switzerland to ship cheese to this country hence the imports dropped to nothing and the production in this country was increased by about 3 million pounds. The production for the past few years has been as follows:

Year	Pounds made
1916	15,317,466
1917	15,435,097
1918	18,586,505
1919	21,601,782
1920	20,430,000
1921	22,678,000
1922	19,983,000
1923	24,555,000
1924	21,844,000
1925	23,457,000

¹ New York Bulletin 184, 1900

² Wisconsin Bulletin 94, 1902.

³ B. A. I. Bulletin 85.

⁴ Wisconsin Station Bul. Res. 27.

MILK POWDER—Milk powder (dried milk) was not invented, it was developed. The process began in a laboratory, where it remained for years, but finally developed into an industry of importance to all dairy countries. Appert, in France, made milk tablets in 1810 and in 1856 Grimwade issued a method of making dried milk. He used some of the modern methods—sugar and carbonate of soda were added to produce granulation and the condensing was done in a vacuum pan, or open jacketed pans, and the mixture was passed between two rollers.

Several patents of importance were granted after the year 1900. The first, perhaps, was the Ekenberg process which was invented in Stockholm, Sweden, by Martin Ekenberg in 1899, and is covered by a number of patents in the United States, beginning in 1904. The process included the spraying of milk into the concave ends of heated drums from which it was scraped.



Merrell-Soule Co.'s Dry Milk Plant, Union City, Pa.

The Campbell process was patented in 1902, by J. H. Campbell.

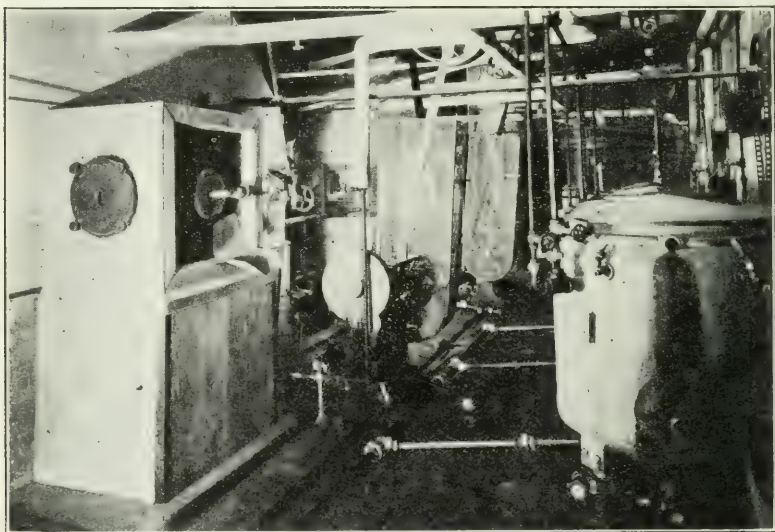
With the invention of the Just-Hatmaker process the industry may claim its beginning. This patent was issued in 1902 and covered a process involving the use of two large rollers which were heated and on which a thin layer of milk was fed. As the rollers

revolved the dry milk was removed by scrapers. The patent was issued to J. R. Hatmaker of London.

The Buflovac Rapid Circulating Evaporator was invented and manufactured by the Buffalo Foundry and Machine Company, Buffalo, N. Y., and the patent granted to O. S. Sleeper in 1911.

The Continuous Concentrator was invented by the By-Products Recovery Co., Toledo, Ohio.

One of the principal processes now in use is the spray process in which the milk is sprayed into a heated room, the moisture



Milk Spraying Apparatus in a Merrell-Soule Drying Plant.

evaporates instantly and the dried milk falls as snow. According to Mr. C. E. Beardslee the development of this process and the great business which it has made possible is as follows:

"Merrell-Soule in 1899 did some experimenting with drying vegetables and in connection with this work W. B. Gere and I. S. Merrell perfected a double roll drying machine, which was patented by the Merrell-Soule Company.

"During 1901 some small quantities of dry milk were produced on the rolls but the product was not satisfactory to the Company. A little later Merrell-Soule sold the apparatus to another company.

"From this time on the Merrell-Soule Company became interested in developing a process for drying milk that would produce a superior product and tried

out several different processes, until L. C. Merrell hit upon the spraying of milk into a regulated current of air.

"In January, 1905, Merrell-Soule equipped a building at Fayetteville, N. Y., to try out the idea and figure the cost to ascertain its commercial value.

"In the meantime in applying for patents on the process, Merrell-Soule Company was referred to a patent issued to Robert Stauf, Posen, Germany, which seemed to cover the process.

"On May 25, F. C. Soule, president of the company, sailed for Germany and after a few days negotiations with Stauf, through interpreters in Berlin and Dresden, purchased the United States patent and also all his 13 foreign patents.

"During 1905 enough milk powder was produced at Fayetteville, New York, to warrant the constructing of a large plant.

"In 1906 the construction of a large milk-powder plant was started at Arcade, N. Y., and milk was received in the early fall. About the same time it was found that by condensing the milk in a vacuum pan before spraying, the fuel cost could be reduced and a better product obtained. Combining the condensing operation with the Stauf patent gave better patent protection and the process was known as the Merrell-Gere Spray Process.

"A large number of companies are drying milk at the present time under license from Merrell-Soule Company.

"Following the first plant built in Arcade, N. Y., in 1906, the development by Merrell-Soule Company has been fairly conservative until now the company owns and operates milk drying plants in New York, Pennsylvania, Wisconsin, and in Ontario, Canada; 16 plants in all.

"The 16 plants have a capacity of approximately 27,500,000 pounds of powdered milk per year."

EXTENT OF THE INDUSTRY—Milk powder is made in the form of whole milk powder, skim-milk powder, and cream powder, while there are a number of grades in these different kinds.

During the year 1925 there was manufactured 8,931,000 pounds of whole milk powder; 73,317,000 pounds of skim milk powder, and 339,000 pounds of cream powder.

Milk powder is used largely for the manufacture of milk chocolate, and in the confectioners' business. The skim powder is used by the bakers and in the ice cream trade as well as in the process of reconstructed milk which is made from butter oil, or unsalted butter, skim-milk powder, and water which are emulsified.

STANDARDS—Federal standards were established by the Pure Food and Drug Act 1907, and adopted in March, 1917, the fat content of dried milk must not be less than 26 per cent, and

the moisture must not be more than 5 per cent. The same moisture content pertains also to skim-milk powder.

MALTED MILK—The process of manufacture of malted milk was invented by William Horlick, of Racine, Wis., in 1883. The product was first placed on the market under the name of "malted milk" in 1887. The vacuum pan is also used in the manufacture of this product and it has become quite a large industry, the product being on sale in all drug stores at the soda fountains, indicating its popularity. There were made in 1925 18,050,000 pounds by 7 factories.

CONDENSED BUTTERMILK AND POWDERED BUTTERMILK—The condensing of buttermilk has become an important industry. It removes large quantities of buttermilk from the butter factories which often has been a burden or a menace. The product is used largely as feed for chickens and pigs although about 10 per cent is used for human consumption, principally in bread. The annual output in 1925 was 77,079,000 pounds.

There are three processes used: The Campbell system, the continuous concentration, and the centrifugal separation.

Most of the buttermilk powder is made by the roller process. The Collis Products Company of St. Paul, Minn., make the greatest quantity of this powder of any firm. The total production for powder in 1925 was 20,246,000 pounds, made by 64 factories.

CONDENSED MILK—The origin and development of the condensed-milk industry is one of America's greatest contributions to dairying. It took the most of a century to perfect and popularize canned milk. The learning of this intricate process and the solving of all the early problems was quite costly and the expense was borne almost entirely by one company—The Borden Company.

EARLY DEVELOPMENT—Gail Borden was the pioneer in the production of condensed milk, that is, the sweetened product. He had been interested in the condensing of food of various kinds for years and believed that some form of condensed milk would be very valuable especially in localities where whole milk could not be obtained. In order to develop such a business it was necessary to have a product that would keep for a reasonable time and that could be easily transported.

From the year 1849 to 1853 he worked to can milk in a condensed form and finally perfected a method of condensing in vacuo. By the use of a vacuum pan the condensing could be accomplished



Mojonnier 7-ft. Vacuum Pan.

Courtesy of Mojonnier Bros. Co., Chicago, Ill.

without using a very high temperature; therefore, the chance of producing a scorched flavor in the product was lessened.

He began applying for a patent in 1853 and although the Patent Office refused his application with the statement that "it lacked the essential requisite of novelty and usefulness," and further that the Patent Office could see no advantage of the vacuum pan over the open-air condensing; however, in 1856 the patent was granted.

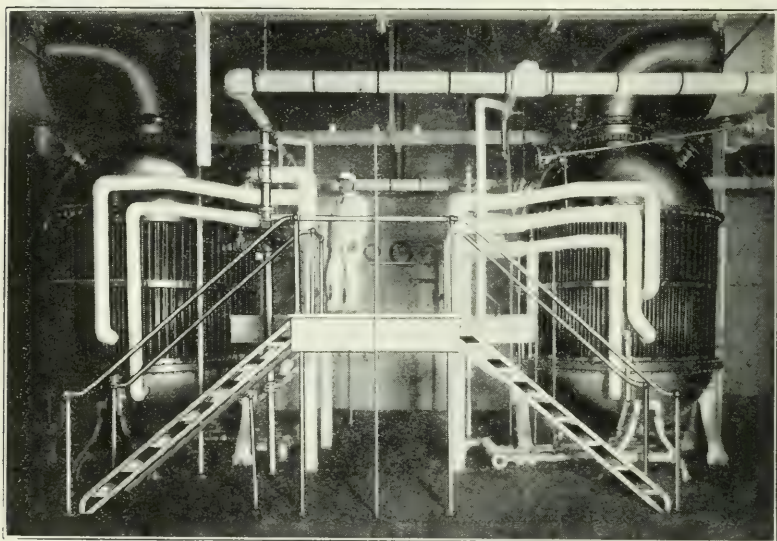
The following from Hunziker gives an idea of the rapidity of the progress of this new industry:¹

"Since the introduction of the process of milk condensing invented and patented by Borden, numerous modifications of the process, as well as entirely

¹ From "Condensed Milk and Milk Powder," 3rd Edition, by O. F. Hunziker

different processes, have been invented in this country and abroad. The most characteristic among these are: Condensation by refrigeration, by centrifugal force, by boiling under atmospheric pressure, by passing hot air through milk, etc. Most of these new processes have not proved commercially satisfactory, with the result that the principle of the process, originally invented by Gail Borden, and which consisted of condensing the milk in vacuo to a semi-fluid liquid, is still made use of in the manufacture of the great bulk of condensed milk produced, both in this country and abroad."

The first factories erected were at Wolcottville, Conn., and in 1856 one was built at Massaic, N. Y.



Courtesy of the Borden Company, New York, N. Y.

But little interest was accorded to condensed milk at the first and the industry struggled along until the Civil War. At the very beginning of the war the value of the condensed milk was recognized and soon the soldiers were being supplied with all that could be made by running the factories at full capacity. The use of this product through the war gave it a place as an industry.

The New York Condensed Milk Company was incorporated in New Jersey, in 1860, and this company was later succeeded by the Borden Condensed Milk Company in 1899.

EVAPORATED MILK—This is the name of unsweetened condensed milk whether in cans or in bulk. It is really a mis-

nomer, as all milk has the water evaporated from it in the process of condensing, but it seems that the name was necessary to secure the patent. What is known as unsweetened condensed milk in foreign countries is called evaporated milk in the United States.

This product came up through great tribulations. The foundation for the production of the product was made by John B. Meyenberg who was born in Switzerland, 1847. After studying and working with the Anglo-Swiss plant at Cham, Switzerland, he perfected his product between 1880 to 1883, but his countrymen would give him no encouragement. He finally came to America and was granted an American patent in 1883. During the next two years, he helped in the organizing the Helvetia Milk Condensing Company, at Highland, Ill., which made the first package of evaporated milk in 1885. The venture was successful from the start and factories were started in Wisconsin, Illinois, and California. This was the beginning of "Milk from contented cows."

Another important improvement in the condensing of milk was the adoption of a continuous condenser. A machine of this character was patented by the By-products Recovery Company, of Toledo, Ohio, organized in 1913. The principle is as follows:

"To rapidly move a film in layer formation within a cylinder having a heated surface, having means for escaping vapors and means for keeping the surface bright and clean, circumferentially and from the point of inlet to the point of outlet."

POLICIES—In the struggle of the condensed milk industry to overcome the many problems of making a product with keeping qualities and at the same time preserve the palatability of the milk the manufacturers were led from the first, directly toward sanitation. This sanitation, it was soon learned, had to begin with the herds and soon the requirements of the condenseries to which every farmer supplying milk must subscribe, included clean herds, clean barns, and a high class of cleanliness in all the production and handling of milk. The stables must be well lighted, utensils clean, and the elimination of all feeds that tainted milk. As the business grew these rules became more and more exacting.

It is noticeable that wherever condenseries are located the general appearance of the farms has been improved, owing to the better methods of dairying required by the condenseries. These require-

ments are necessary to the procuring of clean milk and clean milk is necessary to the condensing of a milk that will keep.

EXTENT OF THE INDUSTRY—At the present time there are about 300 factories making the various kinds of condensed and evaporated milk in the United States. The State of Wisconsin has the largest number of factories and in 1914 had 26 factories, in 1918, 52, and in 1926, 70.



Lebanon, Ind., Plant of the Indiana Condensed Milk Co.

The production of condensed and evaporated milk was highest during the World War when millions of pounds were furnished to Europe. The export of this product continued for some time after the war ceased and was especially valuable in the relief sections of the Near East and in Russia during the famine.

The production in the United States for the year 1925 was 348,898,000 pounds of condensed milk and 1,408,960,000 of evaporated, total 1,757,858,000 pounds.

There is one other product manufactured in condenseries and called by the trade "plain condensed." It is unsweetened, is used for the manufacture of ice cream and is partially condensed and partly curdled.

MILK SUGAR—Milk sugar as a by-product has been made in the United States for many years. The earliest record is made of the effort of Dr. Gerber of Little Falls, N. Y., who in 1881 started the manufacture of milk sugar. This product was discovered early in the 18th century in Switzerland and in the 19th century it was also made in the Netherlands, England, and Germany.

The first record of production was for the year 1914 when 4,051,320 pounds were made in the entire country. In 1897 there were but 4 or 5 factories.

The production of milk sugar is not large as the market is not extensive, it being used mostly in the preparation of infant foods and in drugs, therefore, it has not achieved large proportions as has the other dairy products of the United States.

Production of milk sugar (sucrose) :

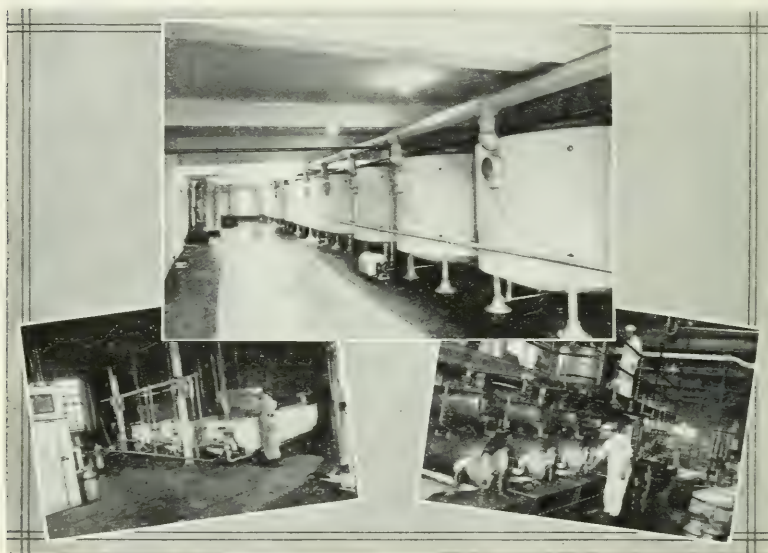
Year	Pounds made
1914	4,051,320
1916	1,844,228
1917	2,155,076
1918	3,219,461
1919	6,615,874
1920	5,583,000
1921	2,890,000
1922	2,191,000
1923	2,872,000
1924	3,331,000
1925	5,655,000

Imports have been negligible except for the years 1914 and 1915 when there was an import for 1914 of 578,727 pounds and for 1915, 250,212 pounds.

ICE CREAM—Ice cream is a relatively new industry with an old history. The idea of iced sweetmeats, or other frozen dainties, had its origin possibly in the early days of Egypt or Babylon. Definite descriptions of these delicacies are not found nor are the dates more definite, simply that iced foods were used among royalty and the very wealthy on state occasions is all that is found in researches covering many centuries. During that time snow was brought down from the mountains for all cooling purposes.

The "Outline of Ice Cream History" as published by the Ice Cream Trade Journal, (1925), New York, N. Y., gives the following information relative to the early beginnings of this industry:

"Rome when in its power used quantities of snow from the Alpine Mountains to cool the beverages and sweet desserts for the tables of the Caesars, and at a later date the kings of France appear to have withheld secret recipes for frozen sweetmeats.



Interior Views of Ice Cream Plant of Southern Dairies, Washington, D. C.

"There are few references but it is enough to know that the desserts known as ice cream were at first chilled and afterwards creams were the first to be frozen into ice cream. that is. creams have been used from the first and has simply been perfected.

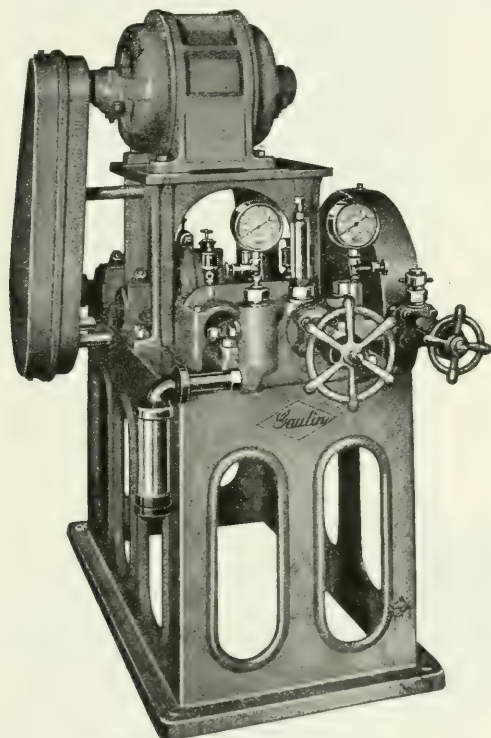
"With the development of the sciences and inventive art the application of freezing mixtures were added to make these iced products, but it was still a luxury for the special few.

"The kind of ice cream made in Italy was introduced into France about 1660, and from France into England about 1700. (The ice cream made in Italy and introduced into France and England was probably the Italian ice cream of to-day which is called 'Spumoni,' and it is still made in European countries and in the United States. Spumoni is much sweeter than the regular ice cream and is harder; It sells for a higher price but is preferred by many people of foreign birth.)

"A letter written by Lady Mary Wortley Montague on October 1, 1716, makes possibly the first reference to ice cream in England, to be found. This letter justifies the belief that both creams and fruit juices were used to some extent in England in the first half of the 18th century.

"In 1769 the term 'ice cream' first appeared in printed record, so far as information is available, when it was used by Elizabeth Raffald in 'The Experienced Housekeeper.'

"Ice cream came to America probably with the English colonists of the early 18th century, for it is true that the legends of ice cream are found in the history



The Gaulin Homogenizer.

Courtesy of Manton-Gaulin Mfg. Co., Boston, Mass.

of our first presidents in connection with their State banquets. The first advertisement, of record, was in the New York 'Post Boy' on June 8, 1786, in which Joseph Crowe invited all New York to purchase his product.

"Early in the 19th century the making of ice cream in retail stores for sale became more common, but later it developed into a business, although generally in connection with some other business, such as drugs, confectioners, etc..

"An American housewife invented a freezer which stirred the mixture continuously while it was being frozen. This was the forerunner of the 'batch'

freezer which was used commercially up to about the year 1900, being made in varied sizes.

"It is generally agreed that Jacob Fussel, a milk dealer in Baltimore, Md., was the first man to make ice cream which was wholesaled to dealers. He began manufacturing for wholesale trade in 1851 in Baltimore, and in 1856 he opened a second store in Washington, D. C.¹ and one in Boston, while in 1864 he started business in New York, N. Y., and the last-named business is still operating under the name of J. M. Horton Ice Cream Company.

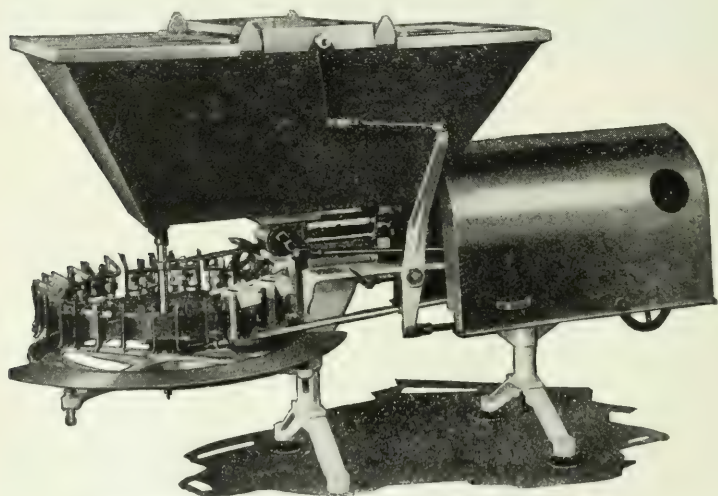
"The first plant in St. Louis, Mo., was opened in 1858.

"For years the growth of the industry was slow but the old batch freezer had popularized the product and everywhere ice cream was enjoyed. Up to the year 1900 it was a side line, largely, but with the invention of the continuous freezer, which is operated with mechanical refrigeration, and the development of the wholesale business, it began to grow rapidly. This was much encouraged by artificial refrigeration which was becoming more economical and had the desired factor of sanitation.

"In 1902 the homogenizer was invented in France and brought to the United States and was commonly used inside of 2 years; however, the patent was not granted in the United States until 1904. This machine is largely used in the manufacture of ice cream as it is used to emulsify the fats, that is break up the fat globules, giving the cream a richer appearance and greatly improving the product.

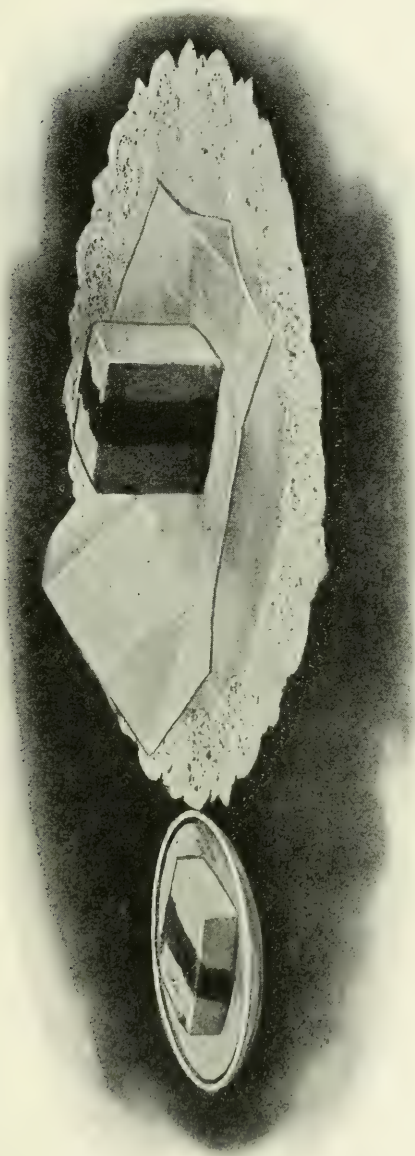
"In 1900 the Association of Ice Cream Manufacturers was organized (the name was later changed to the 'National Association of Ice Cream Manufac-

¹ The Washington firm was still doing business in 1926.



Mojonnier Ice Cream Packaging Machine—Model A.

Courtesy of Mojonnier Bros. Co., Chicago, Ill.



Three Flavor Brick Ice Cream, Packaged Automatically.

Courtesy of Mojonnier Bros. Co., Chicago, Ill.

turers). In 1905 the Ice Cream Trade Journal was made the official organ and the industry thereafter moved forward as an organized unit in the problems of business, legislation, and in a national advertising program.

EXTENT OF THE INDUSTRY—In 1900 the output of ice cream by wholesale manufacturers did not exceed 25,000,000 or 30,000,000 gallons in the year, but by 1910 the output had quadrupled and the capital invested was estimated at \$75,000,000. This expansion has continued and the annual increase has been rapid, in 1915 the estimated production was 175,224,270, and in 1920, 251,820,000 gallons, and in 1925, 322,729,000 gallons, or a per capita consumption of 2.8 gallons.

During the year more than \$200,000,000 were spent for equipment, improvements, and supplies, while the 4,000 factories employed more than 50,000 wage earners and paid out \$75,000,000 in wages.

It requires the milk of more than a million cows producing more than 4,000,000,000, and there is used in the making of the ice cream about 571,000 barrels of sugar to sweeten the ice cream for the year. The ice used, or equivalent refrigeration, amounts to 76,410 tons a day.

This industry is not only strong financially but has great ability to make sudden expansions and thus use large quantities of cream or unsalted butter. Their machinery and equipment are of the latest pattern and highest order that can be purchased. While the industry began with a batch freezer and long-handled spoon it now has machinery to meet all demands for service, such as, continuous freezer, homogenizer, improved testing equipment, improved sanitary equipment, conveyors, packaging machinery, can-filling machinery, ice and salt cabinets, refrigerated cabinets, hardening rooms, motor-truck service, viscolizer, a complete refrigerating plant, and much equipment for distribution of the product.

The industry has played to the American taste and fancy in every possible way, especially in the form of service in ice-cream parlors, soda fountains, and in a multitude of forms, styles, shapes, etc., such as cones, which began in 1904 at the Lewis and Clark Exposition and the Eskimo pie which swept the country in 1922. While there are now so many kinds of ice cream that it is impossible to know them all, still they help to popularize the product and keep up the per capita consumption. The grand total consumption of ice cream in the United States increased 13 per cent during the year 1925.

At the present time ice cream is used on all occasions. It is served with meals or used as dessert after the meal, and is a suitable delicacy for day or night. It is the first thing given a sick person and the best thing to give a well one. All love it from the baby to the oldest in the family and it is really an American favorite.

MARKET MILK—For the first 200 years after the settlement of the colonies little was said about the milk sold in the cities but it was the custom for each family to have its own cows. Of course, there was some milk bartered and sold but it was years be-

fore such business could be called marketing milk. As the selling of milk became a business we find regulations and laws being passed to safeguard the supply. The first law aimed to prevent the adulteration of milk with water was passed in Massachusetts in 1856 and it was followed by the appointment of an inspector in 1859 to enforce the law, however, it was not until 1861 that an inspector of farms was appointed.

While there was a constant increase in the quantity of market milk there was little improvement in the quality until the invention of glass milk bottles in 1886 by Mr. Thatcher, for use in the delivery of milk, but milk had been delivered in glass jars in Philadelphia in 1885.

DEALERS—Prior to the year 1840 a great many of the farmers living within 12 to 14 miles of Boston were selling their milk daily in the city. The larger producers with 40 or more cows peddled the milk but those with only 4 or 5 cows sold their milk to dealers. Milk was delivered to New York City in the same manner.

"The Common Sense" milk bottle was invented in 1889 and appears to have solved the problem of a sanitary milk bottle for delivering milk to the consumer as a number of changes have been offered but the style of bottle has changed but slightly. The use of bottles was made more practicable in 1886 by the invention of a bottle filler by Dr. Stone. As the glass bottles were sanitary when properly cleaned, the next step was to secure milk free from



Milk Bottles.



Milk Can.

Courtesy of J. G. Cherry Co., Cedar Rapids, Iowa.

disease germs. This step became more and more necessary as the consumption of milk increased and in view of the high mortality of children in crowded cities.

Dr. Soxhlet, of Germany, about this time was boiling milk and bottling it for infant feeding with great success. His methods were

copied in America, but sterilization was changed to pasteurization, and advocated by Dr. Abraham Jacobi, Dr. A. Caille, Dr. R. G. Freeman, Nathan Straus, and J. H. Monrad, and thus pasteurization got its first start in the United States. The increase in the use of pasteurization was slow and it was nearly 30 years, after much agitation and education, before the practice was even fairly universal. New York city in 1900 pasteurized only 5 per cent of the milk received, in 1909 25 per cent, in 1912 33 per cent and in 1920 90 per cent. Boston in 1912 pasteurized 33 per cent of the milk received, Chicago 50 per cent, and Milwaukee 75 per cent. However, the temperatures at which these so-called pasteurizations were made left much to be desired, as they varied from 140° F. to 158° F. and the time required varied from 5 minutes to 30 minutes.

About the year 1907 it was found by Dr. M. J. Rosenau of the United States Public Health Service, and Babcock and Russell, Wis., that practically all of the pathogenic germs could be killed by heating to 145° F., and holding at that temperature for 30 minutes. This established the temperature required for pasteurization by the holder method. The flash method uses a temperature of 165° F. or higher.

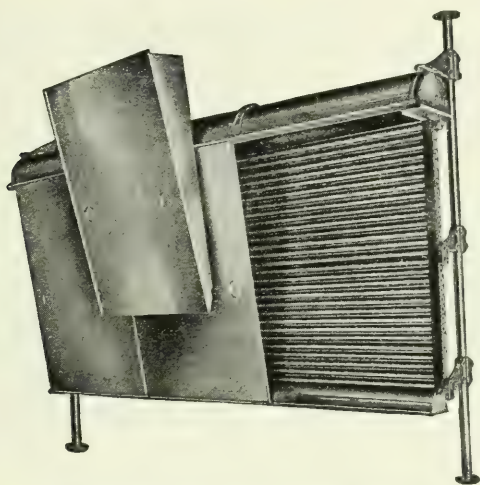
CERTIFIED MILK—Henry L. Coit originated the idea of "Certified Milk" in 1892, for infants, the milk to be produced under the supervision of a medical commission. The first certified milk was produced in May, 1894, at Fairfield Dairy, by Stephen Francisco, under the supervision of the Essex County, N. J., Medical Commission.

MILK DEPOTS—In consideration of the high rate of infant mortality and the malnutrition of children in New York City, Nathan Straus, in 1893, installed milk depots which served pasteurized milk free to undernourished children. The death rate of children under 5 years of age prior to 1893 was 96.2 per 1,000 persons, in 1906 it had been reduced to 55 per 1,000 persons. The first depot was opened at East 3rd Street Pier, New York City. This work was kept up for some years at Mr. Straus's personal expense while he advocated and wrote almost singlehanded in favor of pasteurization for 15 years.

Several inventions have aided in improving the quality of milk used in the cities for household purposes. In 1896 H. B.

Guerler invented and used a practical small-top milk pail, commercial milk filters were devised in 1898 and a number of milk pasteurizers were invented.

The increasing use of the Babcock fat tester after 1890 changed the method of buying market milk. The milk was tested and paid



Surface Milk and Cream Cooler.

Courtesy of D. H. Burrell & Co., Little Falls, N. Y.

for according to the per cent of fat it contained and not by the gallon or hundred weight regardless of the quality as was previously done.

EQUIPMENT OF MILK PLANTS—As the cities of the industrial centers of the country grew and required larger and larger quantities of milk for household use, larger dairies (milk plants) and speedier handling of the milk, the sanitary requirements became more difficult to handle, hence there was need of better and better machinery and equipment, but these were rapidly produced by American genius. (See Machinery page 90.) For the use of the farmer, two types of surface coolers were invented, one cone shaped and the other corrugated. Water was used for cooling and was circulated on the inside and the milk flowed over the outside. There were also invented numerous types of milk cans, sterilizing outfits, cooling tanks, and much of the smaller utensils.

A modern milk plant must have an expensive plant and equip-

ment, including: Equipment for weighing milk, filtering or clarifying, pasteurizing, cooling and storing, bottling, refrigeration facilities, elevating and conveying service, washer and sterilizer for bottles and cans, and modern motor truck delivery service.

Within recent years there have been many valuable improve-



Glass Lined Truck Tank.

Courtesy of The Pfaudler Co., Rochester, N. Y.

ments which alike save time, expense and improve sanitation. Glass lined cooling tanks appeared in 1911, paper bottles in 1906, milk clarifiers, rotary milk bottle fillers and cappers, tank trucks, glass lines in 1924, glass-lined pasteurizers, and finally milk-tank railroad cars, glass lines and refrigerated for hauling milk long distances. By its use milk or cream can be shipped across the continent.

EDUCATIONAL INFLUENCES—In 1863 regulations were passed in Washington, D. C., to govern and protect the milk supply of the city, and ten years later food inspectors were appointed to inspect the milk, but it was not until 1895 that the inspectors were appointed to inspect the milk, but it was not until 1895 that the inspectors were required to visit the dairy farms supplying milk to the city and require reasonable standards of sanitation, 30 years of education.

Milk-for-Health campaigns were started in 1919.

National Cooperative Milk Producers' Federation organized, 1917.

National Milk Dealers' Association organized.

National Dairy Council organized.

The educational milk campaigns in which the government and the National Dairy Council cooperate are generally undertaken to reduce undernourishment in children and to improve the general health by increasing the consumption of milk. These campaigns last from one to two weeks during which time the value of milk is stressed in every way possible. A later survey is made to ascertain the development resulting from the campaign and the increase in the milk consumption. Many cities have used these campaigns to bring the use of milk up to a proper standard and in general when such a campaign was properly handled the results were much greater than expected. This is one of the principal causes for the great increase in milk consumption in the United States. In 1917 the per capita consumption was 42.4 gallons, and in 1920 it was 43.0 while in 1925 it was 54.75 gallons.

A suggestion of the underlying causes of milk consumption in the large cities is given in the American Medical Association magazine "Hygeia," as follows:

"Downtown business houses in Boston are taking up the mid-session milk drinking habit and are finding that it reduces the time lost through sickness. It started through a suggestion of heads of the department as a remedy for fatigue and fainting spells of office girls who came breakfastless to work and who lunched on pink drinks and confections. Without any charitable or welfare object, the executives are using it to build up stamina in their workers."

The receipts of milk by railroad trains and truck service in our largest cities is so large that it is hard to realize. The following table shows the receipts in New York, Boston and Philadelphia.

Year	New York	Boston	Philadelphia
Year	Gallons	Gallons	Gallons
1893	85,910,000	.....	.....
1900	115,022,000	.....	.....
1910	200,049,000	37,657,000	25,152,000
1920	307,431,000	56,734,000	41,595,000
1925	397,099,000	83,645,000	54,807,000

This shows for New York a gain of 245 per cent in the last 25 years, or an increase of practically 10 per cent a year, however, the gain in the last five years has been slightly over 4 per cent.

A recent release by the United States Department of Agriculture, dated June 21, states:

"Milk consumption in the United States last year reached the highest point in the Nation's history, the quantity of milk, including cream, consumed in fluid form being 54,326,000,000 pounds, an increase of 1,554,000,000 pounds over 1924.

"The figures are estimates by the Department of Agriculture on the basis of surveys and reports from Municipal Boards of Health in 450 cities having a total population of 39,158,576.

"The per capita consumption of milk and cream for the country as a whole is estimated at 1.20 pints a day. Milk consumption increased in most of the larger cities, especially those having a well-organized system of supply or in which milk campaigns have been conducted recently.

"Consumption of milk in cities of the 11 Atlantic Coast States and the District of Columbia is estimated at 1.05 pints per capita; in Central States 0.9 per capita; 14 Southern States 0.6 pints per capita, and 11 Western States 1.01 pints per capita.

"Per capita consumption of cream for 360 cities averaged 0.64 of a pint a day."

The total production of milk in the United States for the year 1925 as estimated by the Department of Agriculture was 116,-505,395,000 pounds, of which 54,325,776,000 pounds was used for household purposes in fluid form. That is to say, 46.9 per cent of all milk produced in the country is used as milk in the households, of course, including hotels, restaurants, and other eating houses.

CONSUMPTION OF DAIRY PRODUCTS—Dairy products have been used for human consumption in almost every way possible; as a rare delicacy, as an elegant dessert, as a light refreshment, and as a regular, necessary part of the diet. Butter at one time was thought to possess medicinal properties but now all dairy products are considered valuable if not essential in the diet on account of the vitamins and food in them. The vitamins in dairy products are so important, according to Dr. McCollum, that the health and stamina of the people depend upon a sufficient quantity of dairy products and other substances containing vitamins consumed by all growing children. The discovery of vitamins in milk and its products has caused great earnestness in the efforts to increase the per capita consumption of these products.

Another valuable feature in the consumption of butter has

been noted. When there is a decrease in the per capita consumption of meat, as occurred in the United States and Europe between 1907 and 1913, there is a corresponding increase in butter consumption. One explanation has been offered, i. e., that the loss of protein of the meat is made up by an increased consumption of bread and the butter simply accompanies the increased bread consumption. Cheese, however, may actually take the place of meat. During the period from 1895 to 1906 there was a decrease in the per capita consumption of cheese in Great Britain which was claimed to be due to an abundance of cheap meat. Again, at the close of the World War when cheap lamb meat reached Switzerland from New Zealand it immediately replaced cheese in the

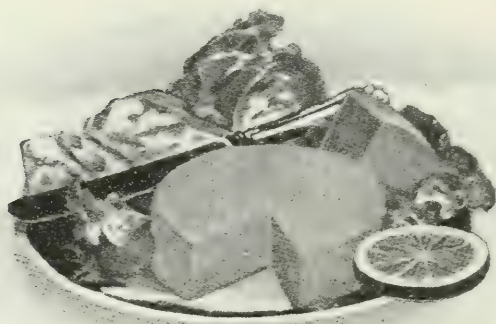


The Cheese Consumption Is Low in the United States.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

domestic diet and the quantity of cheese for export was increased enough to cause a decline in the price of Swiss cheese in the United States. The price of meats in the United States, Canada, New Zealand, Australia, and Argentina is considered the principal cause for the low per capita consumption of cheese in these countries. The consumption of cheese in each of them is scarcely 4 pounds.

TREND OF CONSUMPTION—The earlier civilizations were located in semi-tropical climates and required less fat than is needed in the temperate zones hence they never were great consumers of dairy products. The early pastoral people, however, lived largely



Popularizing Cheese.

Courtesy of the Phenix Cheese Co., New York, N. Y.

upon their flocks and herds. With the beginning of settled peoples, the establishment of stable governments, and the invention of gunpowder (1350) there was a decided change in the livestock. Firearms soon reduced the wild game and more and better cattle were required to supply meat. This may be called the beginning of the split between the beef and dairy types of cattle. The consumption of products of milk of the Middle Ages was generally confined to the country within which produced as there were no large international trade in dairy products. Lack of transportation facilities, jealousies and wars retarded such trading.

Dairy products were consumed generally throughout Europe during the period from 1600 to 1880. Such consumption was increased in practically all countries, especially cheese and butter, and an international trade in dairy products became an important part of commerce. During this period the manufacturing industry began a separation from agriculture and thereby took much of the work previously done on farms to the cities. These cities began a growth which has continued, forming great centers of consumption for dairy and other products. American agricultural and dairy products began to appear on the foreign markets however by the year 1880 the supply of dairy products for the world were not



Dairy Barn and Stable, Dutchland Farms, Montello, Mass.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

sufficient to meet the demand. The consumption of dairy products which is confronted by an ever increasing consuming population and an ever decreasing acreage of pasture has always found a ready market.

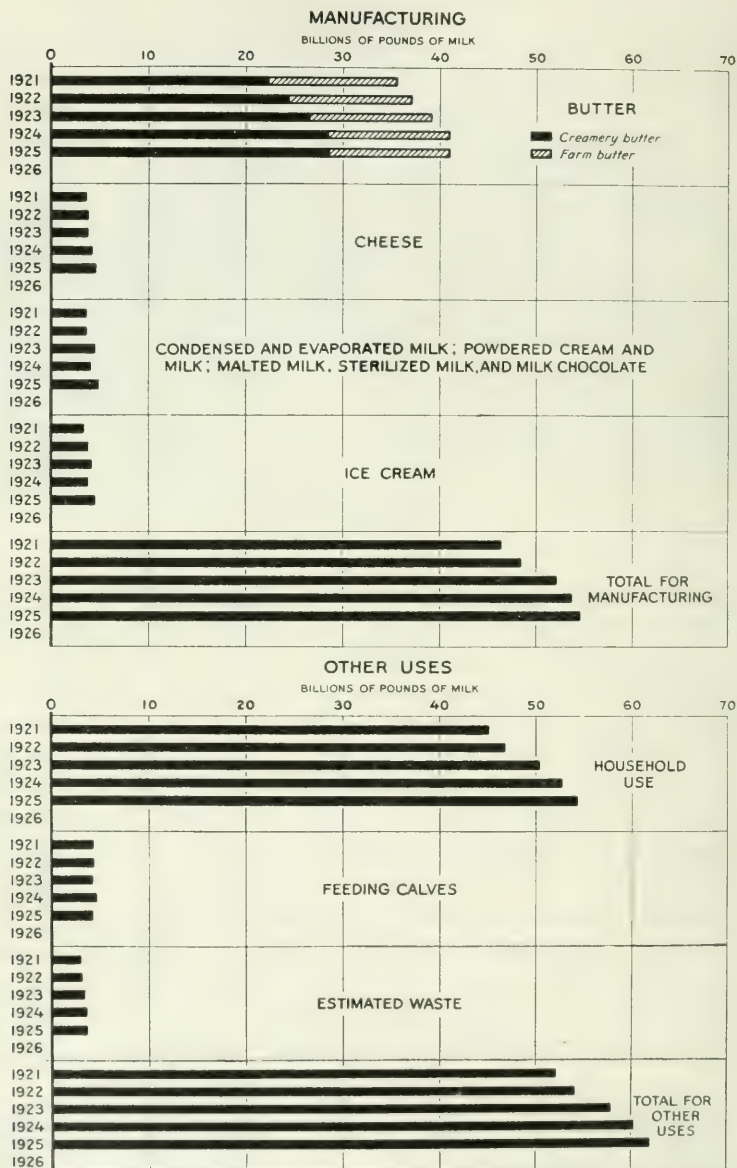
After the year 1880 there was a great increase in the production of butter and cheese but the consumptive demand was sufficient to dispose of it and to also take many millions of pounds of substitutes and imitations. These imitations and substitutes are: Olcomargarine, renovated butter, farm butter, ladled butter, and blended butter. It might be considered that the consumptive demand is equal to the total disposal of all genuine and all imitations sold during the year; if so, butter production has never equalled the demand.

It is impossible to state what the world consumption of butter amounts to but it possibly reaches more than 4 billion pounds annually.

MILK CONSUMPTION—From the earliest time to the present there has been great quantities of milk drunk and used in cooking in cities and on farms. The farmers have always consumed greater quantities per person than the city people. The proportion

USE OF MILK IN THE UNITED STATES

1921-1925



in the United States is about three times greater in the country than in the cities. There has been a great increase in the consumption of milk in recent years but the increase has been mostly in the cities as the farmers' families have about all they desire. This increase in cities has been relatively continuous since the improvement in transportation, the invention of tinware, glass milk bottles and the application of sanitary methods, that is, the improvement of quality precedes increased consumption, but the item of greatest interest is the rapidity of the increase of consumption for so large a country. The grand total of milk for household purposes increased from 36,500,000,000 pounds for 1917 to 54,325,000,000 pounds in 1925.

In the City of New York the market milk consumption has increased each year from 5 to 8 per cent, and in 12 years it has actually doubled its receipts of milk. While the population has increased rapidly the consumption of milk has increased even more rapidly, and now amounts to a million gallons a day.

The average consumption in the United States for the year 1925 was 54.75 gallons of milk, including cream, and the consumption has been increased from 42.5 gallons in 1917. Each person in the country required 1,012 pounds of milk to supply him with milk and dairy products for the year 1925.

BUTTER CONSUMPTION—The per capita consumption of butter in the United States has varied between about 14 pounds and 20 pounds per year ever since 1850 and in 1925 it was 17.04 pounds for all butter, and still with this small consumption it requires nearly half of the butter of the world to supply the demand. The production of butter within the country is just about equal to the demand for butter as over a long period the exports and imports nearly balance.

Annual Per Capita Consumption of Dairy Products in the United States.

(Revised, 1926.)*

	Milk	Butter	Cheese	Cond. and Evap.	Ice
	Gals.	Pounds	Pounds	Milk Pounds	Cream Gals.
1849	.	13.9	4.0	.	.
1859	.	15.1	3.2	.	.
1869	.	13.7	3.3	.	.
1879	.	15.8	2.1	.	.
1889	.	19.5	2.9	.	.

*Division of Dairy and Poultry Products (August, 1926).

Year	Milk Gals.	Butter Pounds	Cheese Pounds	Cond. and Evap.	Ice
				Milk Pounds	Cream Gals.
1899	...	19.9	3.7	.....	.....
1909	...	18.0	3.85 ¹	.....	1.04 ²
1914	.....	17.0	4.60 ¹	.....	1.68
1916	.....	15.4	3.04	.....	2.08
1917	42.4	14.6	2.89	10.49	2.07
1918	43.0	14.0	3.00	12.50	2.14
1919	43.0	14.8	3.50	12.30	2.49
1920	43.0	14.7	3.50	10.17	2.46
1921	49.0	16.1	3.50	11.40	2.28
1922	50.0	16.5	3.70	12.69	2.43
1923	53.0	17.0	3.90	13.25	2.68
1924	54.75	17.25	4.20	14.00	2.50
1925	54.75	17.04	4.26	14.87	2.80

THE DAIRY PRESS—As a factor in the presenting of any cause to the public, possibly none are more active and none can produce quicker results than the press. In the dairy industry the press has been especially active in the presenting of new ideas and the pressing for old ones which were considered pertinent to the needs of the industry. For example, it took about 15 years to introduce the factory system just prior to the beginning of the dairy press, while the cream separator which was invented by Dr. De Laval in 1878 was introduced in 1879 into the United States and in 1882 into Canada; also, the homogenizer which was invented in France in 1902 was in 1904 in use in the manufacture of ice cream in the United States, much to the credit of publicity in the press.

The dairy press in this country has covered the usual field of news and publicity of special dairy events, such as fairs, conventions, shows, auctions, public sales, and have made news out of any special performance of dairy cows, of herds, or of regions, such as "The Elgin District," "The Tillamook District." The press has been the "voice of the industry" in announcing new discoveries, inventions, or methods. It was equally the voice of the industry in keeping an open forum for the discussion of all matters of interest to dairymen. It held up to the public all schemes, plans, methods, and helped weigh each of them, and often helped discard some of them.

¹ Including cottage cheese, not included for other years.

² For the year 1910.

The press gave able leaders a chance to discuss important subjects of all kinds. It has been the usual custom of the press to be favorable to new subjects or to remain silent until the matter has been tested. Some of the questions in which the press of the country have taken a worthy part are:

The dairy breed, i.e., a special purpose cow.	Supporting dairy schools and dairy associations.
Development of cooperation.	Discussing the values of various feeds and rations.
Introducing the butterfat tests.	Advocating laws against substitutes for dairy products.
Cream grading	Illustrating and advocating the latest models of all kinds of dairy equipment and machinery.
Tuberculosis eradication.	Advocacy of parchment paper for lining buttermilks.
Popularizing dairy standards.	
Creating a sentiment for better practices.	
Advocating refrigerator car service.	
Value of the silo and silage.	

In point of years Hoard's Dairyman is the oldest dairy paper in the country. It was established in 1870 in Lake Mills, Wis., being for a few years a minor part of the weekly paper, Jefferson County Union, but later it was moved to Fort Atkinson, and the dairy portion became the Hoard's Dairyman, with W. D. Hoard as editor and owner. The first copy as it now appears was issued in April, 1889. Mr. Hoard was a vigorous editor and took an unusual interest in the dairy industry. His knowledge of the needs of the present was apparently always true while his vision of the future was accurate even beyond a man's ability to know. In each generation a few are given to see the possibilities of the dairy industry—Mr. Hoard was one of these favored men.

A few of the leading papers as published at this time are as follows:

Hoard's Dairyman, Ft. Atkinson, Wis.	Pacific Dairy Review, San Francisco, Calif.
New York Produce Review, New York, N. Y.	The Dairy Farmer, Des Moines, Ia.
The Milk Reporter, Essex, N. J.	The Creamery Journal, Waterloo, Ia.
The Milk News, Chicago, Ill.	The Ice Cream Trade Journal, New York, N. Y.
Chicago Dairy Produce, Chicago, Ill.	The Ice Cream Field, Atlanta, Ga.
Dairy Record, St. Paul, Minn.	The Creamery and Milk Plant Monthly, Chicago, Ill.
Olsen Publishing Co., Milwaukee, Wis.	

The files of these papers if investigated would show that prac-

tically all the subjects relating to the industry are handled every few years quite completely and in the whole accurately.

Bureau of Dairy Industry of the United States Department of Agriculture

PURPOSE OF THE FEDERAL AGENCY—According to the annual report of the Chief of the Bureau of Animal Industry for 1897:

"The Department of Agriculture was impressed early in its history with the many and difficult problems connected with the animal industry of the country that needed solution, Most important among these problems were the diseases which often caused disastrous losses. The second Secretary of Agriculture called attention to "the prevalence of fatal maladies among all varieties of farm animals, resulting in the annual loss of not less than fifty million dollars," and recommended the establishment of a division of veterinary surgery."

"The Dairy Division which collects and disseminates information relating to the dairy industry in the United States, was organized in 1891."

This division (made into a bureau July 1, 1924) was established, according to Houck's history of the Bureau of Animal Industry, to aid and encourage this rapidly growing industry.

The industry had grown to enormous proportions. The butter production was more than a billion pounds in 1890, while the cheese production had reached about 270 million pounds. The exports of American cheese had exceeded 140 million pounds in a year. The supply of market milk to the large cities had also grown to a very large business. The sanitation of manufacturing plants and the sanitary handling of milk had received little attention. Regulations and city ordinances were few and unsatisfactory to the public and to the milk distributors.

Major Henry E. Alvord was made the first chief of the Dairy Division. The early work of the division was confined to the collecting and disseminating of information relative to dairying as carried on in the United States and in foreign countries.

The milk supply of 200 cities was investigated and a report of the findings published showing the efficiency of the supply and the sanitary methods. Major Alvord died at the St. Louis Exposition in 1904, and was succeeded by Ed. H. Webster in 1905; In 1909

B. H. Rawl became chief and in 1921 Dr. C. W. Larson became chief; however, the division was changed to a bureau July 1, 1924, and Dr. Larson has continued in the position of chief.

The work of this bureau has been carried on by a force of scientific investigators, including bacteriologists, chemists, and experts in breeding, cow testing, buttermaking, cheesemaking, condensed milk, dry milk, casein, feeding, dairy engineering, and technology.

SOUTHERN ACTIVITIES—The purpose of this work was the extension of dairying in the South and it was begun in 1905 under the leadership of B. H. Rawl, and later continued under J. H. McLain. The work was in connection with the State colleges and experiment stations and consisted in cattle improvement, farm dairying, barn improvement, the establishing of cheese factories in the mountain States, introduction of silos and organizing cow-testing associations. This work was taken over by the States in 1920.

COW-TESTING ASSOCIATIONS—The Bureau of the Dairy Industry is gathering the records of most of the cow-testing associations in the country and tabulating them for the use of the entire dairy industry. More than 100,000 cows from nearly all the states have been tested and their records tabulated by the bureau.

MANUFACTURING WORK—A section was organized in 1906 for the purpose of studying, experimenting, and investigations in factory problems of all kinds of dairy products together with the application of the results to the regularly operated factories. This section also maintained inspectors on the two principal markets to inspect butter and cheese and to study market conditions, prices, and practices. The inspection work was taken over by the Bureau of Markets in 1917.

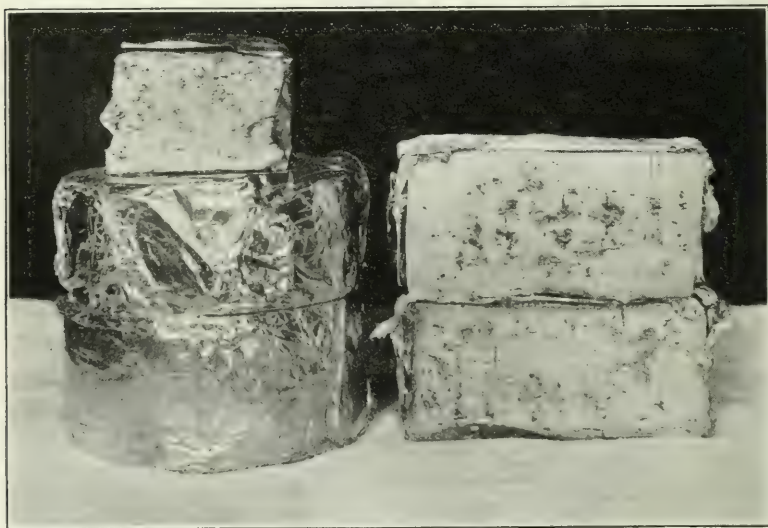
Each year since 1902 the bureau has supervised the manufacture and packing of butter for the U. S. Navy Department, varying from 500,000 pounds to 10,000,000 pounds, per year. The bureau established standards calling for sweet cream in the manufacture of this butter.

RESEARCH LABORATORIES—The work of the dairy research laboratories covers investigations in milk secretion, butter produc-



Grove City Creamery, Pa.

tion, foreign varieties of cheese, bacteriological and chemical problems with milk, ice cream, and the utilization of by-products. L. A. Rogers began this work in 1902.



Roquefort Cheese Made From Cows' Milk, Grove City Creamery, Pa.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

BREEDING—This line of the work was begun in 1917 to determine the methods of breeding that will insure the uniform transmission of large production of milk. Line breeding is to be compared with outbreeding.

In 1918 herds of purebred Holsteins were gathered at the Beltsville, Md. experiment farm, Ardmore, S. Dak., and Huntley, Mont., and were used as a comparison of line breeding versus outbreeding. Nine States are cooperating through their agricultural colleges in these breeding projects.

The bureau is operating a number of experimental farms on which the various problems of feeds, feeding, breeding, and the handling of cattle are being studied.

Other subjects being handled by the bureau are: Dairy engineering, including design, sanitation, and water supply. Dairy statistical studies were started in 1915 covering production, international trade, market receipts and prices, and cold storage stocks; however, this work was transferred to the Bureau of Agricultural Economics in 1922.



Dairy Barns, U. S. Experimental Farm, Beltsville, Md.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

NATIONAL DAIRY ASSOCIATION

The National Dairy Association (National Dairy Show) had its beginning in a noble idea and grew in the same atmosphere. The early workers in the association had many difficulties, hard work, and periods of depression but persevered until they could look back upon worthy achievement.

The charter of the original National Dairy Association was issued in 1905 by the State of Illinois, to J. A. Walker, W. W. Marple, and L. C. Hamilton, as commissioners. The capital stock was fixed at \$10,000 which in 1911 was raised to \$25,000, and the headquarters were to be in Chicago, Ill.

The first show was held in the Coliseum, Chicago, Ill., in 1906, with J. A. Walker as acting president. The first regular officers were: President H. B. Gurler, Vice-president Prof. H. E. Van Norman, Treasurer Granger Farwell, Secretary and Manager E. Sudendorf, and General Superintendent of Livestock A. J. Glover.

In 1911 Professor H. E. Van Norman was elected president and in 1912 a general manager was employed to give his full time to the National Dairy Show and from that date the show began to broaden out until at the present time it truly "represents the dairy industry of this country and the show has become an indispensable factor in the agricultural and commercial life of the nation." W. E. Skinner was chosen as the general manager in 1912 and still occupies the position.

In 1915 the association was reincorporated setting out the following purposes, according to the yearbook of the association:

"The object of the association is to advance and promote the dairy industry and the cause of dairying by educational, promotive and demonstration means and work, as well as the holding of exhibitions and shows of dairy cattle, dairy and farm equipment and machinery and all products of the dairy industry, as well as any and all things connected therewith; also to cooperate with other dairy associations or organizations for the development and promotion of the dairy industry and all of its allied industries. To promote and encourage the making of dairy products from milk and cream, as well as their use and consumption in cooking and for food, and generally to do all things incidental to or relating to the purpose and objects above enumerated."

The National Dairy Show has been held each year, except

1915, since 1906, generally in October. The places and dates of the shows were as follows:

Year	Place	Year	Place
1906	Chicago, Ill.	1917	Columbus, Ohio
1907	Chicago, Ill.	1918	Columbus, Ohio
1908	Chicago, Ill.	1919	Chicago, Ill.
1909	Milwaukee, Wis.	1920	Chicago, Ill.
1910	Chicago, Ill.	1921	St. Paul, Minn.
1911	Chicago, Ill.	1922	St. Paul, Minn.
1912	Chicago, Ill.	1923	Syracuse, N. Y.
1913	Chicago, Ill.	1924	Milwaukee, Wis.
1914	Chicago, Ill.	1925	Indianapolis, Ind.
1915	(No show was held)	1926	Detroit, Mich.
1916	Springfield, Mass.		

ACTIVITIES OF THE ASSOCIATION—The activities of the association have led to the forming of three separate national organizations of great importance to the dairy industry—The National Dairy Council, the World's Dairy Congress Association, and the American Dairy Federation.

The National Dairy Council was organized on account of the need for strong cooperative action by the industry to inform the public of the value of dairy products. It was made an active organization in 1914 with M. D. Munn as president.

At the Dairy Show of 1919 B. H. Rawl, chief of the Dairy Division, U. S. Department of Agriculture, raised the question as to whether the United States would like to have an international dairy show similar to those in Europe. Much interest was manifested, the organization completed, and Professor H. E. Van Norman was selected as president. The first World's Dairy Congress was held in 1923, in connection with the National Dairy Show, in Washington, D. C., and Syracuse, N. Y.

The American Dairy Federation was organized October, 1922, at St. Paul, Minn., "for the development of the industry and a closer cooperation of all existing organizations." The organization was completed December 5, 1923, and Hon. Frank O. Lowden was made president.

The following quotation from the yearbook of the association gives a full statement of the position, aims and extent of the association:

"Today the National Dairy Exposition is the leading exponent of the American Dairy Industry. Impressive in its beauty and completeness, it pictures in a vivid way the importance of the dairy industry in the world's industrial organization. It is a graphic representation of the entire industry, from dairy cattle on the farms through every process and channel of handling, distribution and manufacture on milk and dairy products, down to the consumer. It is owned and operated by the dairy industry—not for profit—but for the advancement and betterment of the industry as a whole; to present the case of dairy agriculture from the aspect of its stupendous value and in the relation of its products to human life and welfare; to create a spirit of industry conscientiousness in relation to the obligation of those engaged in the industry to the consuming public; to promote improved methods in the production of milk and the manufacture of its products; to stimulate increased consumption of dairy products and to bring greater prosperity to all engaged in the several branches of the dairy industry. It illustrates in a striking way just what is being done in the modern dairy world and how it is being done."

One of the principal attractions for the State agricultural colleges is the students' judging contest—judging livestock. This contest is a part of the Dairy Show and each of the dairy breeds is judged by teams of students representing the different state colleges. The college team winning the greatest number of points in the contest is awarded a cup, trophy, scholarship, or similar prize.

Each year the champions of each of the dairy breeds are selected with suitable honors and awards—namely, Ayrshire, Brown Swiss, Holstein-Friesian, Guernsey and Jersey breeds.

ICE AND REFRIGERATION—A large commercial demand has long existed for ice's cooling and preserving qualities, especially in tropical and semitropical countries and even in the summer months of the temperate countries. The means naturally suggested was the bringing of snow down from the mountains as needed or storing it for use. The Greek and Roman writers mention snow from the mountains and refer to the manner of houses used for storing the snow, but it was only as a luxury for the few.

In 1805 ice was shipped from Boston to Martinique, by Frederick Tudor, as an aid in a yellow fever epidemic, but the shipment was a failure.

In England and Scotland the wealthy have had ice houses for one or two hundred years on their great estates. These houses were filled during the winter. However, in England the ice was

generally thin and none was put up for sale until 1845, and then only to a few first-class fishmongers. Ice from Norway was brought to London in 1825. In New York it was not a commodity to be bought or sold until 1825 though it was used by butchers at an earlier date.

Ice houses of the early period were usually dug into the ground and straw and saw-dust used as insulation.

In the United States it was difficult as late as 1820 to obtain ice in our northern cities and the southern cities were entirely without it, but it became a commercial product in Boston about 1800, and was kept in store houses and carried around to those who would buy it.

After the finding of prehistoric animals preserved in ice in northern Siberia, and the meat palatable, interest was renewed in ice preservation of foods but the people were slow to put it into use.

The use of ice for hospitals and for the sick room began in the 19th century.

REFRIGERATION—Chemical and mechanical processes of manufacturing ice have been long known, but it has not been possible to make ice at a low cost to be profitable.

In 1755 Dr. Wm. Cullen made an ice machine using a vacuum pump.

In 1878 F. Windhausen produced ice in quantities.

In 1834 John Hague and Jacob Perkins made an ether machine.

In 1868 J. Dovy suggested refrigeration for vessels for the transportation of beef and in 1869 he demonstrated how it could be done. Refrigeration was first used in a vessel crossing the ocean in 1879 when a Coleman air compressed machine was used.

Siebe's ether machine was the first to make thin plates of ice. A better machine was Carre's ammonia ice machine. These machines produced ice at a cost of from \$4 to \$6 per ton. Since that time many machines have been invented and much improvement has been made in the motive power to operate the machines for either refrigeration or ice making. Refrigerating machines of varying capacity were made at reasonable prices, for the cooling of hos-

pitals, the preservation of meats, the maintenance of temperatures in laboratories, and for use of ships, railway cars carrying perishable fruits, meats, or other products requiring controlled temperatures.

REFRIGERATOR CARS—These cars first appeared in 1867 and were used between Chicago and New York. In general these cars consisted of an ordinary box car having the sides and top and bottom insulated and containing ice bunkers at each end of the cars; in fact, the cars at the present time are of similar construction, the ice being renewed at regular intervals while the cars are en route.

The Michigan Central Railroad in the early 60's sent a refrigerated car of meat from Chicago to New York. The car held from 2,000 to 3,000 pounds of ice. In 1857, W. W. Chandler, of the Star Union Line, had 30 box cars fitted for carrying ice refrigeration, and they were called "ice box on wheels;" however, it is stated that these cars were used for carrying dairy products.

According to Weld, the railroads of this country in 1885 owned only 660 refrigerator cars and in 1905 they owned 45,570 cars. The interest in this matter is further attested by the fact that more than 400 patents issued on patents intended as improvements of these cars.

Refrigeration is very necessary today in all lines of manufacture of dairy products. Many of the fine qualities found in the various dairy products depends on the control of temperatures of milk or cream from the time it is milked until it is on the table of the ultimate consumer. This is true for all the products like market milk, ice cream, commercial buttermilk, cheese, condensed milk, and even butter.

All large factories have refrigerating plants to furnish refrigeration or ice.

COLD STORAGE—The use of ice in the maintenance of temperatures for the holding of dairy products has long been in use. Ice houses were first made for this purpose.

In the creamery the use of ice was made more necessary after pasteurization became a common practice about 1890. The cooling of the milk or cream quickly after pasteurization was considered of great importance.

The increase in the manufacture of ice cream beginning in 1900 and continuing to 1926 has required great quantities and also refrigeration both for the manufacture of the cream and for the hardening room which became part of the equipment about the same date.

Very large commercial cold-storage warehouses for the holding of all kinds of perishable products, near the large markets, have given the dairy industry a great service. These houses hold the butter, cheese, and condensed milk for a short or long time, making possible the preserving of the high production of the summer months, for the use in the months of short production of the winter. The butter is held at temperatures from 4° F. to -10° F., while the cheese is held just above the freezing point. The following table gives the holdings of butter and cheese in the United States for the high and low months over several years:

(Thousand pounds—000 omitted)

Year	Creamery butter		Cheddar cheese	
	May 1	Sept. 1	May 1	Sept. 1
1916	1,082	105,836	6,546	46,776
1917	3,607	108,179	7,928	91,545
1918	9,536	99,334	17,736	55,742
1919	9,659	131,388	6,027	76,661
1920	7,554	115,558	16,963	60,372
1921	7,712	92,796	13,466	46,706
1922	3,830	112,039	18,980	66,875
1923	3,248	102,731	21,158	80,766
1924	8,913	156,440	40,235	95,211
1925	3,744	128,403	39,037	95,472
1926	17,490	138,151	47,450	81,297

At least one third of the total factory made butter of the country is stored for some period of the year, while the cheese reaches possibly one-half. This in addition to the cold curing of the cheese which is now practiced.

TANK CARS—The milk-tank cars which appeared in 1924-25 were glass lined and refrigerated, in several forms, but permitted the hauling of much larger quantities of milk on a car and also gave excellent service in maintaining the proper tempera-

ture. The cars hold 5,800 gallons of milk and have been known to carry milk from Wisconsin to Florida and keep it in perfect condition.

COOPERATION

COOPERATIVE MARKETING—There are several forms of cooperative marketing and selling associations in the United States, and some of the largest are those dealing with dairy products.

While these selling agencies are selling their products as their principal business they are also interested in the production of better and better qualities of product. In most cases they have established standards of both methods and sanitation which have been urged upon the members and the quality has been greatly improved. This is especially true in regard to cheese and butter.

TRANSPORTATION—As the roads and railroads were improved over the country, especially between the years 1800 and 1840, and with the opening of the Erie Canal in 1825, there was a corresponding increase in the quantity of dairy products marketed. Butter, cheese, and lard, combined, which were shipped over the Erie Canal in 1835 was 1,030,632 pounds, and in 1840 3,422,687 pounds.

The first cheese from Ohio was marketed down the Mississippi about the year 1820.

The railroads had their greatest expansion beginning about 1840 and within the next 20 years the entire northern section east of the Mississippi River was covered with railroads, while the Southern States had many lines. These roads connected the eastern seaboard with the central section and made the marketing of surplus dairy products easier. In 1840 there were about 2,000 miles of railroad, in 1850, 7,000 miles, and in 1860, 30,626 miles.

By lengthening the life of the products it was possible to reach more distant markets, and refrigeration accomplished this for the dairy products in 1867. With the introduction of the refrigerator cars the perishable products could be held at practically the same quality as when they started. This made it possible for the large cities to reach further into the country for whole milk and

by doing so they pushed the butter and cheese factories back from the great markets.

Motor trucks were introduced about 1911 and have done much to aid in promptness and economy of delivery of dairy products from both farm and milk plant to the consumer.

FOREIGN MARKETS—Before the year 1800 the greatest market for dairy products was in the export trade and from 1791 to 1807 butter and cheese combined averaged $2\frac{1}{2}$ million pounds annually. The year 1800 seems to be a turning point in America, as the invention of machinery began to replace the handwork on the farms and much that was previously done on the farms was being done in cities where craftsmen specialized and thus agriculture was split off from manufacturing. The manufacturing cities soon became markets for dairy products. This was largely brought about by the leaders of agriculture through writing, fairs, associations, and publicity; however, this contributed to the making of labor even more scarce on the farms.

COOPERATION—The late Henry C. Wallace, while Secretary of Agriculture, made the following statement which may as well be attached to cooperation as to agriculture:

"During the next 20 years, either consciously or unconsciously, the United States will adopt fairly definite policies as to industry and agriculture. We are approaching that period which comes in the life of every nation, when we must determine whether we must strive for a well-rounded, self-sustaining national life in which there shall be a fair balance between industry and agriculture, or whether, as have so many nations in the past, we shall sacrifice our agriculture for the building of cities."

THE PRINCIPLES OF COOPERATION—The following sketch from a speech of the President of the United States, Calvin Coolidge, states the principles of this phase of industry and clearly outlines its possibilities:

"We want cooperation preached as a principle, not a panacea. It will not perform miracles. It will not accomplish the impossible. But it is a sound, tried, demonstrated principle that must be introduced at the basis of our agricultural establishment. It demands that the individual shall surrender some part of his complete independence for his and for the general good. It means that a certain authority must be delegated, and when delegated it must be supported. There must be faith, good will, patience. It must be understood that no very spectacular achievement will be wrought.

"The cooperative association which establishes grades and standards, en-

courages the good and eliminates the poor varieties, increases the efficiency of production, provides a unified product adapted to its markets, organizes its distribution, creates confidence in its products and its methods—that kind of an association is doing the best that cooperation can do. It will serve both the seller and the buyer. Under wise leadership, and, most of all, leadership that will not desert the farmer, but will stay by him.”

ORIGIN OF COOPERATIVE DAIRYING—Much has been written about the early cooperative societies but the idea of helping, trading work, bartering with products, and such, are all so closely allied to a cooperative society that it is hard to tell just which society first became a cooperative as now known. George K. Holmes, in the *Society of Agricultural History*, and also in *Hoard's Dairyman*, gives the following as part of the history of the origin of cooperative dairying and how it was accomplished:

“The cooperative dairy has gone through various phases of form, beginning with the first simple form in the course of its development, but its history in this country does not fully describe the cooperative dairy through all of its phases. As the history now stands, the first cooperative dairy in this country was established by Jesse Williams, a farmer living near Rome, N. Y. He had a contract to supply cheese from his farm and the adjacent farm of his son. It occurred to him that it would be a waste of economic effort if he and his son were to make cheese independently of each other, so the two farmers combined and built a small cheese factory in which cheese was made for both farms. That was in 1851.

“I use the word dairy in the true sense—that is, a building or room where milk is kept and milk products made, and not in the sense often observed, indicating a herd of cattle kept for milk.

There was, however, a co-operative dairy in its primitive form in this country that antedated the cheese factory of the Williamses, and perhaps antedated it by many years. To understand this a little better, let me remind you of Brentano's investigation of the origin of the cooperative dairy. You will remember that, historically, he traced the cooperative dairy back to the 11th or 12th century, I have forgotten which, in the mountains between France and Switzerland, and found that its beginning was a matter of milk borrowing among neighbors. One peasant did not have enough milk to enable him to make cheese, because, as you know, milk must be used promptly in cheesemaking. But the neighbors, all together, had enough milk for a cheese if the milk were combined, and so the milk of his neighbors was borrowed by peasant A on Monday, for instance, and peasant B borrowed the milk from his neighbors on Tuesday, and so on until each neighbor had had his turn at borrowing. Nowadays this is what we would call a cheese ring.

“Eventually this crude system of borrowing seemed uneconomic to the peasants, and so they established a central place to which they took their milk every

day. At that place they kept the cheesemaking apparatus, which they all owned in common. Then each man took his turn at making cheese for one day and that cheese belonged to him.

"Now to come back to the United States. My mother was a farmer's daughter and lived in the southwestern corner of Massachusetts. I have heard her say that in her childhood days her father borrowed milk from some of his neighbors, for the purpose of making a cheese, and that each neighbor in turn borrowed from the others for the same purpose until the borrowing had been completed around the circle, and the procedure was repeated throughout the season. When the borrowing began I have not ascertained, but it was practiced certainly as far back as 1835.

"It is interesting to know that the first historic phase of the cooperative dairy existed in the United States many years ago, and that it naturally grew out of an uneconomic situation just as it did in the mountains of western Switzerland, 800 or 900 years ago."

The factory system of manufacturing butter and cheese seems to have given dairying such an unlooked-for start that the dairymen, in their earnestness, pushed into other fields and added them to dairying, such as the cooperative idea, marketing, distributing, buying in mass, insurance, and even the state and national breeders' associations followed the factory system, or the development resultant from the factory system. Other organizations were started and were functioning in the interest of cooperation:

The National Grange, Patrons of Husbandry, 1867; Farmers' Union, in Texas, 1902; Farmers' Alliance and Roachdale System; American Society of Equity, 1902; Consumers' Cooperative Organization, 1920; American Farm Bureau Federation, 1920; Dairyman's League Cooperative Association, 1907, active 1916; Milk Producers' Association of Chicago; New England Milk Producers' Association; Interstate Milk Producers' Association; Wisconsin Cheese Producers' Association; Tillamook County Creamery Association, 1903; St. Lawrence County Creamery Association; Twin City Milk Producers' Association; Franklin Cooperative Association, Minneapolis, Minn., 1919; American Federation of Creamery Buttermakers; American Dairy Federation, and Land O' Lakes Creameries, Inc., 1921.

The incentives to cooperation are generally summed up as follows: to secure capital, to secure more product, to improve marketing conditions, to improve the quality of the product, and to get more power.

COOPERATIVE FACTORIES—The number of cooperatively operated factories which manufacture some kind of dairy products has increased ever since the Civil War, but the butter and cheese

factories are by far the most numerous. These factories are principally in the North Central States with Minnesota first in number of creameries and Wisconsin first in cheese factories. The greatest development in number of factories occurred just prior to the year 1890. These factories are not large, and are owned and managed by farmers who do all the buying and selling.

Not much effort has been made to organize the cooperatives of the States or Nation until the last 5 years. The first efforts were made by milk producers with varied success.

The Dairymen's League Cooperative Association is one of the most successful milk producers' associations. It was organized in 1907 but was not really effective until 1916. Its purpose was the marketing of milk, wholesale, to the city of New York, regulate the supply, adjust the price, and improve the quality of the milk. Their efforts have done much to establish the principles of co-operation throughout the country. In 1925 this association had 65,000 members and 225 manufacturing and fluid-milk plants with an output of product valued at \$75,000,000.

The Wisconsin Cheese Producers' Association was organized in 1914 for the purpose of selling the cheese of its members. In 1924 it had in its control 210 warehouses and handled about 28,000,000 pounds of cheese.

The Tillamook County (Oregon) Creamery Association is a cheese-selling cooperative association organized in 1903. In 1924 there were 25 factories in the association and the turnover was 7,386,000 pounds of cheese. This cheese has a very high reputation and commands a premium.

The St. Lawrence (N. Y.) Cheese Producers' Association in 1924 had 26 associations and sold about 6,000,000 pounds of cheese.

The Twin-City Milk Producers' Association of St. Paul, Minn., has 15 plants and in 1924 handled about \$7,000,000 of milk, gross sales.

The Franklin Cooperative Association, Minneapolis, Minn., (a consumers' cooperative buying association) began in 1919 as a result of a milk-wagon drivers' strike but has developed into one of the most successful cooperative associations in the dairy industry. It now has 400 members and 6,500 stockholders, serving

50,000 families with milk daily. It has built two fine buildings, one of which contains an auditorium for the meetings of its members, and has a life insurance from \$500 to \$1,000. The growth is shown by the amount of sales—in 1921, \$855,063; 1922, \$1,670,693; 1923, \$3,106,991; 1924, \$3,301,591. The association handles all kinds of dairy products and eggs.

The Land O' Lakes Creameries, Inc., was organized in 1921 for the purpose of selling the butter manufactured by its members. It began with the federation of 15 creameries and has increased until in 1925 there were 476. For the purpose of effective work the state was divided into 16 equal parts and assigned to 16 fieldmen to instruct the buttermakers how to make sweet-cream butter, that is, making butter from cream which is not allowed to sour and in which no starter is used. It has 447 unit associations and 73,000 members and the turnover in business for 1925 was \$38,889,000. This organization has collective shipments of butter from the central office in Minneapolis, after the butter has been scored, and graded by a government official, and the score has been placed in each pound package. It maintains offices in New York and Philadelphia but does most of its business directly with the retail trade. A large part of the butter scores 92 points or better.

Milk Producers' Association of Central California was organized in 1917 and now has 1,496 members. The turnover for the year 1925 was \$2,988,000.

It will be noted that practically all of the cooperatives mentioned have been organized since the World War, which brought heavy taxes, higher cost of living, higher ideals of living, and also keener competition in all business lines with agriculture and dairying slightly handicapped. Cooperation, therefore, was more of an economic measure than a look into the future.

According to A. H. Benton the purposes of cooperation may be summed up as follows:

"These farmers' cooperative marketing agencies are assisting their members in improving their methods of production; are taking advantage of carload rates; are reducing overhead expenses through handling of a large volume of business; are buying supplies for members at wholesale prices; are given a wider and more uniform distribution of products handled; establishing byproduct plants to utilize culls and surpluses and establish high standards of quality which will enable them to sell their product at a premium."

The message of Sir Horace Plunkett to the Cooperative Congress at Philadelphia adds the real purpose of cooperation:

"It is only when the members of the rural community have learned to come together in the business of their lives that they can be easily induced to cooperate for higher things—for the intellectual and social advancement. Thus, better business is the foundation alike of better farming and better living."

COOPERATION—France took it up when the vineyards failed, Denmark, England, Netherlands, Sweden, Switzerland, and Germany took it up to meet competition, New York took it up when the soil became worn out, and Wisconsin took it up when wheat failed.

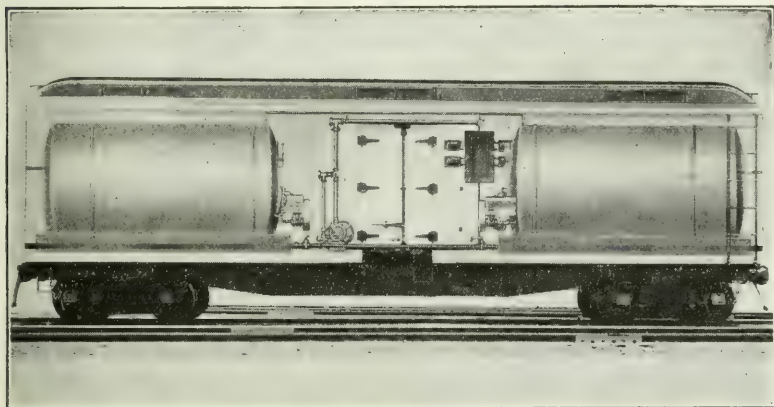
CLEANSING POWDERS (Wyandotte)—The development of the cleansing powders is practically the same as the development of the J. B. Ford Company and its exploitation of Wyandotte. This firm began business in the year 1902 and probably is the oldest firm that is solely engaged in the manufacture of cleansing materials. The first material tried along this line was for use in the washing of clothes but shortly after it was brought out, the dairyman's cleaner and cleanser was placed on the market. That was 24 years ago and the quantity made has increased continually since that date. This cleanser was produced after much laboratory and practical research work had been done as it was desired to obtain a product which did not contain organic matter and that was capable of quick rinsing and still leave all surfaces odorless. Such a washing powder was essential to the dairy industry with its multiplicity of utensils and equipment which must be kept clean and free from bacteria of all kinds.

The consumption of Wyandotte is perhaps the best indication of the growth of this business and is indicated by the increase in branch offices. Twenty-five years ago there were no branch offices, but today there are 30 in this country and Canada, one in Australia, and one in New Zealand. The company engages 20 foreign agents to cover all the dairy countries of the world and in the United States it requires 1,500 selling agents to handle the dairy trade alone.

MARKETS—All the colonial settlers possessed cattle at an early date. The Plymouth Colony had no cattle the first 3 years and the Jamestown Colony had none the first four years. Records

of that time indicate that much attention was paid to the quantity and also to the quality of the milk and it is especially noted that:

"The market for milk was limited by the difficulties of transportation and even in the largest towns, such as Boston, cows were kept. Butter and cheese were made on every farm but were not of high quality; hence the people



Refrigerated Tank Car.

throughout the 17th century and until the end of the 18th imported a large part of their butter and cheese from England and Ireland."¹ (Possibly a large amount was imported but not a large part.)

It is not known how large the importations of butter and cheese were but there was a large trade in dairy products between the Colonies. Bidwell gives some of the more important facts about the marketing of products and the establishment of the first markets:

"New England was early selling butter to New Netherlands (New York). The Massachusetts Bay Colony after 1650 began to export butter and cheese. Winthrop said of the Connecticut Colony that in 1660 it was exporting butter and other provisions. In 1675 butter and cheese are reported as exported from New England and when there was shown a profit in the export of meat, butter, and cheese the farmers are said to have cleared more land and increased their stock of cattle that a surplus could be spared for export.

"Under the Dutch two fairs were established each year, for cattle, October 15, and for hogs, November 1, and a market space was set aside in 1656 in New York City. Similar markets were established in Philadelphia early in its history. Its rules in 1693 included the following: That all sorts of provisions brought to their town for sale, viz., flesh eggs, butter and cheese shall be sold in the aforesaid market place. The provisions could not be bought on the

¹ History of Agriculture in Northern States, Bidwell and Falconer.

way to the market nor until it had been on the market two hours after the ringing of the bell. for violation of the rules meant forfeiture of one-half to the poor of Philadelphia and the other half to the clerk of the market."

Dairying became a real industry in the middle of the 18th century and the quantities of butter and cheese at that time moving to our markets were large. In 1770 the exports of cheese from the Colonies were 55,400 pounds and in 1801 New Haven alone shipped to New York 220,000 pounds of cheese and 800 firkins of butter (at 56 pounds each).

The Mississippi River was used as a trade channel as the West became settled and in 1810-11, 8,569 boxes of cheese and 41,151 pounds of butter passed Louisville, Ky., on the way to New Orleans, which was already a valuable market for the surplus of farmers of the Ohio Valley.

The distribution part of marketing was in the hands of merchants who gathered provisions during the summer and fall for winter sales. The great trouble with such a market was that it was glutted in times of greatest production and was without provisions at other times. However, this was largely overcome by the farmers "packing the butter solid" in jars during the summer and covering with brine. This summer butter, "June butter," was marketed in the fall and, although quite strong in flavor, was eagerly bought. The cheese was marketed also in the fall of the year when the entire production was taken to the city. The prices were not high, being 10 to 18 cents a pound for butter and 8 to 10 cents a pound for cheese. (The buying power of money was much higher than at the present time.)

Marketing dairy products in the early days of the country and on the frontier, as it moved westward, was strictly a barter in which one product was exchanged for another, or for merchandise, clothing, and groceries, and it is much the same with farm-made butter to-day which is exchanged at the local stores for goods. This method was displaced when money became sound and its circulation was sufficient to do the ordinary business of the country.

The provision merchants of the larger cities specialized in dairy products and later commission merchants and jobbers were established in all the principal markets. This led to the formation of public markets and mercantile exchanges.

EXCHANGES—The New York Mercantile Exchange was founded April 2, 1875; the Philadelphia Produce Exchange in April, 1882; while the Boston Fruit Dealers Association was established in 1883 and incorporated in 1885 and name changed to Boston Fruit and Produce Exchange. The Chicago Butter & Egg Board was organized in 1898 and reorganized September 26, 1919, as the Chicago Mercantile Exchange.

Open markets are maintained in each of these cities and the receipts of butter at these four markets amounts to practically 43 per cent of the total output of creamery butter of the country. The business is done through yearly contracts, straight commissions, or by distributing agencies. Consumers' Associations, wholesale distributors, and large retailers, such as chain stores may, and often do, buy direct on the open market or on the exchange.

Open markets are not used for the handling of the minor products of dairying such as milk powder, milk sugar, casein, malted milk, and the special cheeses, but these products are generally sold on yearly contracts or direct from the factory to the distributor. In fact, butter and Cheddar cheese are the only dairy products handled through the open markets.

Many of the factories are distributing their products direct to the retailer through a central agency or through direct shipments. This method of marketing has increased rapidly in the last few years.

STANDARDS AND GRADES—The New York Mercantile Exchange established definite grades for butter in 1906, and indicated the qualities necessary for each grade. The examination of butter for the purpose of putting a grade upon it is called "scoring" it. The score is composed of 100 points divided as follows: for flavor 50 points, for body and texture 25 points, for salt 10 points, for color 10 points, and for package 5 points. This system of butter scoring has been varied a few times but remains practically the same as has been adopted in principle in a number of countries.

At the present time the Government, through the United States Department of Agriculture, maintains offices at each of the principal markets, New York, Boston, Philadelphia, Chicago, San Francisco, and Minneapolis, Minn., for the purpose of obtaining

accurate information relative to the condition and tone of the market as well as the volume of butter received and the price at which the product is sold, both wholesale and jobbing prices. All information obtainable relating to the markets is published daily.

The receipts of butter and cheese for each of the cities at these principal markets is obtained from the railroads while the price of butter and cheese is obtained from the merchants, commissionmen, and from the sales on the Exchange. The price which is published by the Government is accepted as the basic price for settlement and is called the market price. The price is named for each of the grades of butter and for each kind of cheese on the market.

EXTENT OF THE DOMESTIC MARKET—The markets in the United States have a business that is about equal to the entire production of all the milk produced and of its products as the consumption is larger than the production. Large importations of cheese are made annually.

The New York Market alone received 37,642,432 pounds of butter in 1865, and the receipts of butter have exceeded 100,000,000 pounds ever since the year 1890, while in 1925 the receipts were over 207,000,000 pounds. The butter market in Chicago is even larger than the New York market, receipts for 1925 being 210,000,000 pounds. As New York is the port of exit for most of the dairy products it has a special significance which gives the price of the butter at New York more of a dominating factor than has any other price issued in the country.

The receipts of butter at San Francisco, Calif., average about 22 million pounds annually and as the state of California produces about the same amount as it consumes the market has little effect on the eastern prices of butter.

CHEESE—The great cheese-producing center of the country is in Wisconsin, where large warehouses have been constructed to hold the cheese until properly ripened. Large quantities of the cheese are bought on contract direct with the factories, and much other cheese is sold through the call boards which are operated in the cheese section, once a week, but a great deal of Cheddar cheese is sold on the open markets of the large cities. The two principal call boards are located at Plymouth and Sheboygan, Wis., and in earlier years there were call boards in New York State.

Practically all Swiss cheese is sold on contract direct with the factory.

DISEASES OF CATTLE—The United States might always have been free from cattle diseases if proper precautions had been taken to keep out all infected cattle. This was not done, however, and the cattle diseases have been brought to America many times with destructive and disabling effects.

PLEUROPNEUMONIA—One of the earliest troubles was from pleuropneumonia which was introduced from England in 1843. A constant fight was waged but it was not until 1892 that it was finally eradicated. One benefit accrued from the disease: namely, it was "the immediate cause of the establishment of the Bureau of Animal Industry under the Federal government," which bureau was given authority to slaughter the cattle and eradicate the disease. It took 5 years after the bureau was established to clear the country of the disease which had claimed its thousands of cattle, and not a trace of it has since appeared, although the losses in 1870 amounted to \$1,000,000.

TEXAS FEVER—This disease has caused much heavier losses than the pleuropneumonia and has also been harder to eradicate. When the cattle of the South recovered from the effects of the Civil War and were sent north to market a new disease broke out often killing from 75 to 100 per cent of the infected cattle. Investigations made by the Bureau of Animal Industry found that the disease was carried by ticks which were on the cattle but when the ticks were removed the cattle were harmless as disease carriers. This started the tick-eradication work which has been continued by the government and the states in cooperation since that date. The territory originally covered with ticks corresponded nearly to the cotton states of the South but this territory has been reclaimed and much of the section is tick-free; however, there is still some work to be done.

TUBERCULOSIS—This disease has been known in a way and under various names for centuries but it was not until 1876 that a full description of the bacilli was published by Dr. Koch, of Germany. He later discovered the human tubercle and produced the tuberculin test for testing cattle. The test was introduced in 1890.

The pasteurization of milk was begun in the United States in the year 1897 as a safeguard against disease germ in the milk.

A few breeds of cattle are claimed to have great resistance to this disease namely, Red Poll, Podolian, Chianina, and Steppe cattle, also the water buffalo and Zebu. It is further claimed that tuberculosis was hardly known on the prairies of North America, in Central Africa, and the steppes of Siberia. Denmark was free of the disease at the beginning of the 19th century but later the disease was brought from England and a survey in 1893 found from 38 to 40 per cent of all cattle affected.

The eradication of bovine tuberculosis is being rapidly accomplished in the United States through the cooperation of the states and federal government. The cattle are tested and if found reacting to the tuberculin test they are killed and the owner is paid a certain sum which is furnished by the state and federal government. When a herd is clear of the disease it is classed as a "certified herd." There are many such herds in the country and some states have a number of counties free of bovine tuberculosis. The following table indicates the rapidity with which the country is being cleared of the disease.

Bovine Tuberculosis Eradication

Fiscal year June 30	Cattle tested	Per cent reactors
1918	134,143	4.9
1919	329,878	4.1
1920	700,670	4.1
1921	1,366,358	3.9
1922	2,384,236	3.5
1823	3,460,849	3.3
1924	5,312,364	3.2
1925	7,000,028	3.1

The number tested means the results of the work each year; therefore, the figures are cumulative and indicate that practically one quarter of the cattle of the country have been tested and are free of the disease.

FOOT-AND-MOUTH DISEASE—Centuries ago this disease was called "epozootie" and was considered a dread disease as it removed a large per cent of the cattle and the cattle that recovered had a daily loss of from 2 to 4 pounds in their milk. The records show that since the beginning of the 19th century it has been a

constant menace to the European countries while the outbreaks spread over the country and cause great losses of cattle. A few examples will indicate the severity of the disease.

In 1892 and 1893 Denmark lost 10,843 head and also had eleven other outbreaks between 1880 and 1911. Germany lost over a million head between 1886 and 1905, France lost in one outbreak 33,000 head, Belgium 5,225, Holland 12,000, Italy 18,000, while Great Britain and Ireland lost (killed) 800. This was just one of many outbreaks the latest of which has scarcely been stopped at the present time.

The United States has had several outbreaks but as the government has had authority to slaughter the affected animals, the herds have been quickly segregated and the disease stamped out.

Scarcely will the producers of livestock ever realize the greatness of the service rendered by the Bureau of Animal Industry in its safeguarding of the health of the cattle of the United States.

CHRONOLOGICAL EVENTS

YEAR

- 1611-1800 Introduction of cattle into the country.
- 1800 Natural ice became a commercial product in Boston.
- 1805 Ice shipped from Boston to West Indies for yellow fever sufferers.
- 1820 "Soiling of cattle," written by Josiah Quincy.
- 1822 First Ayrshire cattle imported.
- 1826 First wholesale buying of cheese, H. Burrell, Salesbury, N. Y.
- 1830-31-33 First importation of Guernsey cattle by Pierce of Boston.
- 1837 Financial depression.
- 1838-40 Dutch Belted Cattle first imported.
- 1841 Preemption Act passed by Congress.
- 1841 Thaddeus Selleck shipped the first milk by train to New York City.
- 1843 Pleuropneumonia introduced from England.
- 1846 Gail Borden began experimenting to produce condensed milk.
- 1850 First Jersey cattle imported.
- 1851-2 First cheese factory built in New York by Jesse Williams.
- 1851 Ice cream first sold by wholesale by Jacob Fussel, Baltimore, Md.
- 1854 Reciprocity with Canada—butter and cheese free to both countries.
- 1855 4 hours and 34 minutes labor to produce bushel of corn—in 1894 it took only 41 minutes.
- 1856 Gail Borden received his first patent and built a factory.
- 1857 30 iced-cars used on Star Union Line, made by W. W. Chandler.
- 1858 Wet curd factories erected in Ohio.
- 1860 Alkalies of soda family produced for cleansing—J. B. Ford Co.
- 1860 35½ hours of labor to produce ton of hay—1894 reduced to 11 hours 34 minutes.
- 1861 Homestead law passed opening lands of West.
- 1861 Mechanical refrigeration began to be important.
- 1861 First creamery built near Wallkill, N. Y., by Alanson Slaughter.
- 1861-64 Civil War—great loss of cattle—backset to dairying.
- 1863 American Dairymen's association formed.
- 1863 First cheese factory built in Illinois.
- 1866 First cheese factory built in Iowa.
- 1867 First creamery built in Illinois.
- 1867 First refrigerator car built for use between Chicago and New York.
- 1867-8 Texas fever appeared on feeding grounds of northern states.
- 1868 Reciprocity with Canada repealed—stimulating cheese industry in Canada.
- 1869 Brown Swiss cattle introduced by D. G. Aldrich.
- 1870 Pleuropneumonia causes loss of cattle valued at \$1,000,000 a year.
- 1870 Foot-and-mouth disease introduced into New York.
- 1870 Hoard's Dairymen established, Lake Mills, Wis., W. D. Hoard.
- 1871 First Cheese Board at Little Falls, N. Y.
- 1871 Holstein association formed.
- 1871 Patent issued on "oleo cheese" machinery, Rome, N. Y.
- 1872 Holstein herdbook started.

YEAR	
1873	Financial depression.
1873	Red Polled cattle imported by G. F. Taber, New York.
1873	First silo built in McHenry County, Ill., by Fred C. Hatch.
1873	Shorthorn cattle first imported, by Gaff and Miller, Baltimore.
1873	Oleomargarine patented in this country.
1875	New York Mercantile Exchange organized.
1875 (or 1873)	Dr. Manley Miles made the first silo, probably a pit silo.
1876	First Agricultural College established.
1879	De Laval cream separator introduced from Sweden.
1880	Oil test churn invented, University of Wisconsin.
1881	First experimental silo built by Prof. Roberts at Cornell University.
1881	First milk sugar plant erected at Little Falls, N. Y.
1882	First ensilage congress held at New York City.
1882	Chicago Butter and Egg Board organized.
1882	Philadelphia Produce Exchange organized.
1883	Wm. Horlick invented malted milk. Placed on market 1885.
1883-5	Boston Fruit Dealers established, later Boston Fruit and Produce Exchange.
1884	Square churn patented by David Curtis, Ft. Atkinson, Wis.
1884	Bureau of Animal Industry established in the U. S. Department of Agriculture.
1885	First factory established for making evaporated milk, Illinois.
1885	Skimming stations established.
1886	Mr. Thatcher invented glass bottles for milk delivery.
1888	Dr. A. Caille introduced Soxhlet's sterilizer.
1888	Rose-Gotlieb method for determining per cent of fat in milk.
1889	Milk depots started in New York City by Nathan Strauss.
1889-90	Prof. Conn worked on butter cultures.
1890	Dr. S. M. Babcock invented fat test.
1890	Disbrow invented the combined churn and butterworker.
1890	Dr. A. G. Mann invented Mann's acid test.
1890	First dairy school organized in Wisconsin.
1891	Modified milk prepared and placed on sale.
1892	A. H. Reid invented the "Lafayette" butter printer.
1892	Pleuropneumonia eradicated from the country.
1892	Certified milk originated by Henry L. Coit.
1892	Milk pasteurized in bottles, Chicago World's Fair.
1893	First combined churn built by Cornish, Curtis and Green.
1893	Cornell University building completed.
1894	Stephen Francisco produced the first certified milk, New Jersey.
1895	Pasteurizing machines invented.
1895	Pure lactic starter used in Cheddar cheese.
1895	Dairy Division, organized in the Bureau of Animal Industry, of the U. S. Department of Agriculture.
1896	First starter can made by Sam Haugdahl.
1898	Chicago Butter & Egg Board organized.
1898-1900	Cold curing of cheese introduced.

YEAR

- 1900 Paris Exposition, Sam Haugdahl took first prize for butter.
 Cream buying stations appeared.
- 1900 Cream ripeners began to be used.
- 1901 Milk powder first successfully made by spray process.
- 1902-4 Drum, or roller process for making dried milk, invented.
- 1902 "Friday" hand butter cutter invented.
- 1902-8-14-15-24-25 Outbreaks of foot-and-mouth disease.
- 1904 J. L. Kraft began making processed cheese.
- 1905 Sweet cream butter first made from pasteurized cream.
- 1905 Creamery tests for moisture in butter invented.
- 1905 First cow-testing association organized in Michigan.
- 1905 *Bulgaricus* isolated.
- 1905 National Dairy Show organized.
- 1906 Merrell-Gere spray process for dried milk invented.
- 1906 New York Mercantile Exchange established grades (scores) for butter.
- 1907 Dairyman's League of New York organized.
- 1908 First bull association organized by the Michigan Agricultural College.
- 1908 First "Accredited herd," tuberculosis free, Silver Springs, Md.
- 1910 Feeding standards of Haecker, Savage, Eckles and Morrison completed.
- 1910 Government purchases experimental farm at Beltsville, Md.
- 1910-11 Glass-lined vats used.
- 1913 Pasteurized milk for cheesemaking, experiments by Sammis, Wisconsin.
- 1913 Rettiger's experiments on acidophilus.
- 1914 National Dairy Council began active work, M. D. Munn director.
- 1914 Wisconsin cheesemakers' association organized.
- 1915-20 Discovery of vitamins.
- 1915-20 Motor transportation for handling milk.
- 1915-20 Pure cultures for Swiss cheesemaking, first used.
- 1917 Bureau of Markets established in the Dept. of Agriculture with branch offices in principal markets.
- 1919 Roquefort cheese made from cows' milk by Matheson.
- 1920 Use of pure cultures to produce eyes and flavor in Swiss cheese, J. M. Sherman.
- 1921 Land O' Lakes Creameries organized.
- 1923 World's Dairy Congress.
- 1924 Bureau of the Dairy Industry established in the U. S. Department of Agriculture.

NUMBER OF DAIRY COWS AND OTHER CATTLE ON FARMS
(Bureau of the Census and Bureau of Agricultural Economics)

Year	Dairy Cows ¹ on Farms	Other Cattle	Year	Dairy Cows on Farms	Other Cattle
1840 ²	4,837,043	10,171,586	1911 ³	20,823,000	39,679,000
1850	6,385,094	11,393,813	1912	20,699,000	37,260,000
1860	8,585,735	17,034,284	1913	20,497,000	36,030,000
1870	8,935,332	13,566,005	1914	20,737,000	35,855,000
1880	12,443,120	22,488,550	1915	21,262,000	37,067,000
1890	16,511,950	33,734,128	1916	22,108,000	39,812,000
1900	17,135,633	50,083,777	1917	22,894,000	41,689,000
1910	20,125,432	41,178,434	1918	23,310,000	44,112,000
1920 ⁴	19,671,777	47,139,059	1919	23,455,000	45,085,000
.....	.....	.....	1920 ⁵	21,427,000	47,444,000
.....	.....	.....	1921	21,408,000	45,776,000
.....	.....	.....	1922	21,788,000	45,456,000
.....	.....	.....	1923	22,063,000	44,093,000
.....	.....	.....	1924	22,255,000	42,252,000
.....	.....	.....	1925	22,523,000	39,627,000
.....	.....	.....	1926	22,290,000	37,539,000

¹ Dairy cows in this table means cows kept for milk.

² The figures of this column are from the U. S. Census.

³ The figures of this column are from estimates of the Bureau of Agricultural Economics.

⁴ Dairy breeds only.

⁵ Revised to agree with the Census figures from 1920 to 1926 incl.

AVERAGE ANNUAL YIELD OF MILK PER COW
(Bureau of the Census and Bureau of Agricultural Economics)

Year	Average yield	Year	Average yield
	Pounds		Pounds
1850	1,436	1918	3,936
1860	1,505	1919	3,600
1870	1,772	1920	3,627
1880	2,004	1921	3,945
1890	2,709	1922	4,021
1900	3,646	1923	4,260
1910	3,113	1924	4,368
1917	3,716	1925	4,935 ¹

¹This figure is too high—4,500 lbs. is nearer right.

**TOTAL NUMBER OF CATTLE AND NUMBER OF PUREBRED CATTLE OF
DAIRY BREEDS ON FARMS IN 1920**
(Bureau of Census)

State	Total Cattle	Total purebred Cattle	Total purebred Dairy Cattle	Purebred dairy cattle by breeds				
				Ayrshire	Guernsey	Holstein- Friesian	Jersey	Other Dairy Breeds
Alabama.....	1,044,008	10,633	6,108		46	1,142	4,608	312
Arizona.....	821,918	8,455	3,108	109	48	1,778	669	504
Arkansas.....	1,072,966	13,486	6,950		19	2,001	4,627	303
California.....	2,008,037	32,388	19,144	595	1,145	12,189	3,832	1,383
Colorado.....	1,756,616	33,610	6,448	114	241	4,057	1,605	431
Connecticut.....	173,764	10,961	10,284	1,250	1,566	4,859	2,257	352
Delaware.....	46,509	1,707	1,663		246	1,245	172	
Florida.....	638,981	4,338	2,930	46	68	337	2,380	99
Georgia.....	1,157,432	13,124	8,727	14	305	1,700	6,224	484
Idaho.....	714,903	19,376	4,138	46	197	2,049	1,579	267
Illinois.....	2,803,389	109,996	36,412	202	1,369	25,124	7,317	2,400
Indiana.....	1,546,095	50,624	21,115	509	1,215	8,477	9,921	993
Iowa.....	4,567,708	171,645	20,286	271	1,716	10,916	3,629	3,754
Kansas.....	2,975,390	97,723	17,058	694	477	10,408	4,784	695
Kentucky.....	1,093,453	19,693	8,829	20	40	2,046	6,421	302
Louisiana.....	804,241	6,498	3,415		94	1,009	2,201	111
Maine.....	300,747	18,202	15,683	1,134	1,836	7,206	4,999	508
Maryland.....	283,377	9,588	8,668	113	1,867	4,073	2,323	292
Massachusetts.....	216,099	19,993	18,807	1,880	3,348	10,006	2,904	669
Michigan.....	1,537,214	62,800	46,533	291	3,369	32,702	8,296	1,875
Minnesota.....	3,021,469	88,696	32,668	399	4,468	22,830	2,508	2,463
Mississippi.....	1,250,479	16,001	8,367		101	1,331	6,571	364
Missouri.....	2,781,644	102,939	19,037	110	760	5,569	10,708	1,890
Montana.....	1,268,516	22,994	3,451	13	176	2,453	560	249
Nebraska.....	3,167,279	82,047	7,873	74	348	5,368	1,275	808
Nevada.....	356,390	1,174	405	21	10	197	133	44
New Hampshire.....	163,653	2,656	10,750	1,214	1,151	6,695	1,348	342
New Jersey.....	179,459	11,631	11,538	265	1,747	7,810	1,368	348
New Mexico.....	1,300,335	18,727	1,327		42	438	507	340
New York.....	2,144,244	155,185	153,037	9,521	9,749	114,662	13,411	5,694
North Carolina.....	644,779	10,782	7,697	44	789	1,613	4,978	273
North Dakota.....	1,334,552	33,821	4,797	226	346	2,937	481	807
Ohio.....	1,926,823	96,384	70,882	1,021	4,960	38,327	23,842	2,732
Oklahoma.....	2,087,049	48,252	9,539		91	3,741	5,104	603
Oregon.....	851,108	24,712	12,852	323	697	3,624	7,771	437
Pennsylvania.....	1,540,816	81,290	75,189	3,097	9,618	48,652	11,036	2,786
Rhode Island.....	30,519	1,719	1,651	494	217	542	351	47
South Carolina.....	435,462	6,864	5,184		644	1,008	3,389	143
South Dakota.....	2,374,763	62,348	5,248	85	135	4,027	312	689
Tennessee.....	1,161,846	24,666	11,347		111	1,383	9,424	429
Texas.....	6,249,443	113,107	23,364	19	59	2,973	18,718	1,595
Utah.....	505,578	13,856	2,922		93	970	1,706	153
Vermont.....	435,480	29,758	28,549	3,808	2,193	13,413	8,446	689
Virginia.....	914,674	17,777	9,586	25	1,696	4,160	3,223	482
Washington.....	572,644	18,560	12,720	404	941	7,673	3,402	300
West Virginia.....	587,462	12,485	4,450	272	333	1,134	2,546	165
Wisconsin.....	3,050,829	137,527	114,917	1,712	18,727	80,845	7,791	5,842
Wyoming.....	873,729	17,530	1,071	21	31	747	167	105
Total.....	66,810,836	1,981,514	916,724	30,456	79,445	528,446	231,824	46,553

NUMBER OF COW-TESTING AND BULL ASSOCIATIONS IN THE UNITED STATES

(Dairy Division, Bureau of Animal Industry)

Year	Cow-test- ing Asso- ciations	Bull Associa- tions	Year	Cow-test- ing Asso- ciations	Bull Associa- tions	Year	Cow-test- ing Asso- ciations	Bull Associa- tions
1906	1	None	1913	100	12	1920	408	123
1907	4	None	1914	163	14	1921	452	158
1908	6	3	1915	211	15	1922	513	190
1909	25	8	1916	346	24	1923	627	218
1910	40	9	1917	459	36	1924	no record	
1911	61	11	1918	353	44	1925	732	220
1912	82	11	1919	385	78	1926	777	225

WHOLESALE PRICES OF MILK AND DAIRY PRODUCTS (Trade papers and United States Department of Agriculture quotations)

Year	Milk price in Chicago, net per 100 Pounds	Butter on New York Market per pound ¹	Average of Highest Daily Quotations of Cheddar Cheese New York Market
		Cents	Cents
1875	\$	34.8	19.2 ³
1880	. . . .	30.5	13.7
1885	. . . .	26.8	. . . .
1890	. . . .	23.6	9.5
1895	. . . .	21.3	. . . .
1900	1.35	22.2	11.2
1905	1.34	24.6	. . . .
1910	1.83	31.1	16.4
1911	1.90	27.4	14.1
1912	1.89	31.6	16.4
1913	1.99	32.2	15.4
1914	2.00	29.8	15.6
1915	1.98	29.8	15.5
1916	2.03	34.9	19.0
1917	2.66	42.7	24.4
1918	3.22	51.0 ²	27.2
1919	3.65	61.0	32.2
1920	3.49	61.0	29.0
1921	2.74	43.3	23.0 ⁴
1922	2.38	40.6	22.3
1923	2.57	46.8	25.2
1924	2.50	42.6	20.5
1925	2.45	45.3	24.6

¹ Grade of extras, or 92 score, or equivalent.

² Quotations issued by Bureau of Agricultural Economics. Department of Agriculture.

³ Price for 1870.

From 1919 to date the prices are from the Bureau of Agricultural Economics, U. S. Department of Agriculture.

⁴ From 1921 to 1925 the quotations is for daisies.

MILK: PRODUCTION AND UTILIZATION—UNITED STATES, 1921-1925

Purpose for which milk is used	Milk used per unit of Product	1921			1922			1923			1924			1925		
		Product Manufactured	Whole Milk Used	Per cent of Total Milk	Product Manufactured	Whole Milk Used	Per cent of Total Milk	Product Manufactured	Whole Milk Used	Per cent of Total Milk	Product Manufactured	Whole Milk Used	Per cent of Total Milk	Product Manufactured	Whole Milk Used	Per cent of Total Milk
Butter:	Pounds	Million Pounds	Million Pounds	Per cent	Million Pounds	Million Pounds	Per cent	Million Pounds	Million Pounds	Per cent	Million Pounds	Million Pounds	Per cent	Million Pounds	Million Pounds	Per cent
Creamery.....	21.0	1,054.9	22,153.7	22.408	1,153.5	24,223.8	23.619	1,252.2	26,296.5	23.963	1,356.1	28,577.7	24.923	1,361.5	28,592.1	24.541
Farm.....	21.0	650.0	13,650.0	13.807	625.0	13,125.0	12.797	610.0	12,810.0	11.673	600.0	12,600.0	10.988	590.0	12,390.0	10.635
Cheddar, all kinds....	10.0	355.8	3,558.4	3.599	375.0	3,749.8	3.656	398.9	3,989.5	3.636	417.9	4,179.4	3.645	447.5	4,475.1	3.841
Milk:																
Condensed & Evaporated.....	2.5	1,464.2	3,660.4	3.703	1,431.3	3,578.4	3.489	1,774.9	4,437.2	4.044	1,700.5	4,251.4	3.708	1,757.9	4,394.6	3.772
Powdered.....	8.0	4.2	33.9	.034	5.6	44.8	.044	6.6	52.5	.048	7.9	63.1	.055	8.9	71.5	.061
Malting.....	2.2	15.7	34.4	.035	13.7	30.0	.029	15.3	33.7	.031	15.9	34.9	.031	18.0	39.7	.034
Sterilized, canned.....	1.0	5.1	5.1	.005	.3	.3	.001	.1	.1	.001	.5	.5	.001	1.6	1.6	.002
Chocolate.....	19.0	.....	40.0	.041	.....	100.0	.098	.....	149.5	.136	.....	158.8	.138	.....	228.8	.196
Cream, powdered	19.0	.....	2.5	.002	.....	2.2	.002	.....	6.2	.006	.....	19.3	.017	.....	6.4	.006
Ice cream (gal.)	13.75	*244.0	3,355.0	3.396	*263.5	3,623.4	3.533	*294.9	4,054.9	3.695	*285.6	3,926.3	3.424	*322.7	4,437.5	3.809
Total Milk for Manufacture			46,493.4	47.030		48,477.7	47.267		51,830.1	47.232		53,811.4	46.929		54,637.3	46.897
Milk accounted for otherwise:																
Household purposes.....																
Fed to calves.....			45,143.0	45.660		46,672.6	45.507		50,440.0	45.965		52,772.0	46.022		54,325.8	46.629
Waste, loss, & Unspecified			4,260.0	4.310		4,335.0	4.226		4,174.0	3.803		4,642.8	4.049		4,047.1	3.474
Total Milk Produced			2,965.9	3.000		3,076.9	3.000		3,292.0	3.000		3,440.0	3.000		3,495.2	3.000
						102,562.2	100.000		109,736.1	100.000		114,666.2	100.000		116,505.4	100.000

U. S. Department of Agriculture,
Division of Dairy and Poultry Products.
*Gallons.

TOTAL PRODUCTION OF FARM AND FACTORY BUTTER IN THE UNITED STATES

(Census Bureau and Bureau of Markets and Crop Estimates)

C—Census M—Markets

Year	Creamery and Whey Butter Pounds	Whey Butter Pounds	Farm-made Butter Pounds	Total Butter Pounds
1849 C	.....	.....	313,345,306	313,345,306
1859 C	.....	.....	459,681,372	459,681,372
1869 C	.....	.....	514,092,683	514,092,683
1879 C	29,421,784	.....	777,250,287	806,672,071
1889 C	181,284,916	.....	1,024,223,468	1,205,508,384
1899 C	420,954,016	.....	1,071,745,127	1,492,699,143
1904 C	531,478,141	.....	.....	.....
1909 C	627,145,865	.....	994,650,610	1,621,796,475
1914 C	786,003,489	.....	.....	.....
1916 M	760,030,573	.....	.....	.....
1917 M	759,511,000	.....	710,000,000	1,537,262,709
1918 M	822,718,916	4,543,793	707,666,492	1,587,355,950
1919 M	873,907,132	5,702,326	675,000,000	1,544,917,000
1920 M	866,762,000	3,155,000	650,000,000	1,709,290,000
1921 M	1,057,114,000	2,176,000	625,000,000	1,783,097,000
1922 M	1,155,806,000	2,291,000	610,000,000	1,866,022,000
1923 M	1,254,118,000	1,904,000	600,000,000	1,957,745,000
1924 M	1,356,080,000	1,665,000	590,000,000	1,953,300,000
1925 M	1,361,526,000	1,774,000	.....	.....

BUTTER: ESTIMATED TRADE OUTPUT OF¹ FARM AND FACTORY IN THE UNITED STATES, BY MONTHS

(Thousand pounds—i. e. 000 omitted)

Month	1917	1918	1919	1920	1921	1922	1923	1924	1925
January.....	113,449	108,540	98,853	103,830	118,793	125,824	133,001	142,949	138,884
February.....	103,002	89,522	93,511	96,882	108,397	114,948	116,821	130,846	127,753
March.....	118,331	96,887	111,362	108,363	126,575	134,488	135,855	140,809	143,108
April.....	126,293	113,123	115,567	121,277	139,511	138,617	148,133	154,822	150,604
May.....	167,464	158,741	161,573	155,916	175,366	190,141	194,706	191,908	195,286
June.....	174,582	158,326	148,898	164,201	173,176	175,053	186,512	187,201	179,629
July.....	161,394	141,098	153,579	148,557	166,677	170,247	181,754	176,275	170,728
August.....	156,273	145,589	146,659	147,110	167,613	167,365	182,195	175,439	177,438
September.....	151,301	143,071	136,601	137,956	146,475	158,980	161,127	167,540	172,328
October.....	132,780	121,727	131,870	129,568	146,782	152,601	155,672	161,158	163,609
November.....	119,207	100,783	115,998	120,211	124,883	133,983	141,285	148,757	140,254
December.....	133,227	108,146	107,657	119,719	131,485	133,806	139,709	156,398	145,132

Division of Dairy and Poultry Products.

¹Trade output is equivalent to movement into consumptive channels.

**RECEIPTS OF BUTTER ON NEW YORK, CHICAGO AND
SAN FRANCISCO MARKETS**
(Trade Journals and Bureau of Agricultural Economics)

Year	New York	Chicago	San Francisco
	Pounds ⁷	Pounds ⁷	Pounds ⁷
1865	37,642,432	.....	.....
1870	34,264,215	.....	.....
1880	92,628,631	.....	7,518,165
1890	114,309,155	.....	.....
1900	123,929,788	89,566,523	12,949,023
1905	149,401,910	108,685,277	15,246,265
1910	135,860,037	191,042,215	11,844,070
1911	144,117,805	195,598,333	16,178,560
1912	145,881,398	159,210,898	20,016,523
1913	151,769,500	150,192,531	20,319,335
1914	159,315,535	157,431,876	19,193,808
1915	170,545,929	186,313,367	24,136,770
1916	182,836,728	175,297,615	23,540,155
1917	160,952,038	174,713,514	21,178,175
1918	173,884,639	148,751,044	19,504,865
1919	184,804,888	153,577,162	18,799,134
1920	136,076,050	146,109,386	20,028,394
1921	176,037,468	160,035,330	21,879,475
1922	204,333,214	176,161,530	22,028,821
1923	207,031,330	186,736,684	21,684,012
1924	211,273,742	213,349,006	22,449,027
1925	207,317,000	210,228,000	25,000,000

⁷ Estimated at 62 lbs. per tub net.

IMPORTS AND EXPORTS OF BUTTER
(Commerce and Navigation)

Year	Imports	Exports	Year	Imports	Exports
	Pounds	Pounds		Pounds	Pounds
1851 ¹	479,180	3,994,542	1915	3,828,227	9,850,704
1860	3,278,967	7,640,914	1920	20,770,959	27,155,834
1870	4,089,038	2,019,288	1921 ²	18,558,388	8,014,237
1880	487,120	39,236,658	1922	6,957,159	10,937,519
1890	75,521	29,748,042	1923	23,741,247	5,845,514
1900	49,791	18,266,371	1924	19,404,816	8,256,622
1910	1,360,245	3,140,545	1925	7,212,013	5,342,740

¹ Year ended June 30, 1851 to 1920.

² Year ended December 31 1921 to 1925.

**TOTAL PRODUCTION OF FARM AND FACTORY CHEESE
IN THE UNITED STATES**
(Census Bureau and Bureau of Agricultural Economics)

Year	Factory Cheese	Farm Cheese	Total Cheese
	Pounds	Pounds	Pounds
1849 ¹	.....	105,535,893	105,535,893
1859 ¹	.....	103,663,927	103,663,927
1869 ¹	109,435,229	53,492,153	162,927,382
1879 ¹	215,885,361	27,272,489	243,157,850
1889 ¹	238,035,065	18,726,818	256,761,883
1899 ¹	282,634,488	16,372,330	299,006,818
1904 ¹	317,144,872	.....	.....
1909 ¹	311,175,730	9,405,864	320,581,594
1914 ¹	377,513,409	.....	.....
1916 ²	314,716,739	.....	.....
1917	372,540,203	.....	.....
1918	352,621,615	.....	.....
1919	379,319,548	.....	.....
1920	362,431,000	.....	.....
1921	355,838,000	6,000,000 ³	361,838,000
1922	369,980,000	5,000,000	374,980,000
1923	394,697,000	4,250,000	398,947,000
1924	413,940,000	4,000,000	417,940,000
1925	443,514,000	4,000,000	447,514,000

¹ Census figures used for the years 1849 to 1914.

² Dept. of Agriculture figures used for the years 1916 to 1925.

³ Farm cheese figures prorated from the year 1921 to 1925.

**ICE CREAM: PRODUCTION IN THE UNITED STATES, 1909-1925,
ESTIMATED**
(Thousand gallons—i. e., 000 omitted)

Year	Gallons	Year	Gallons	Year	Gallons
1909	¹ 80,000	1915	175,224	1921	244,000
1910	95,450	1916	208,320	1922	263,520
1911	138,000	1917	² 210,000	1923	294,900
1912	160,000	1918	220,000	1924	285,550
1913	172,380	1919	230,000	1925	322,729
1914	163,761	1920	260,000		

¹ 1909-1916, inclusive, from the International Confectioner.

² 1917-1925, inclusive, from Bureau of Agricultural Economics, Division of Dairy and Poultry

**PRODUCTION, IMPORTS AND EXPORTS OF CONDENSED AND
EVAPORATED MILK**
(Bureau of Agricultural Economics)
(Department of Commerce)

Year	Production	Imports	Exports
	Pounds	Pounds	Pounds
1879	13,033,267	.....	.....
1889	37,926,821	.....	.....
1892		1,062,250	not reported
1899	186,921,787	.....	.....
1900		472,958	.....
1904	308,485,182	.....	.....
1909	495,197,844	.....	.....
1910		598,134	13,311,318
1914	875,507,438	14,599,339	16,209,082
1916	997,835,115	18,174,505	159,577,620
1917	1,353,605,594	18,375,698	259,102,213
1918	1,675,477,360	29,926,931	529,750,032
1919	2,046,879,968	20,183,723	728,740,509
1920	1,578,015,000	19,080,642	708,463,187
1921	1,464,163,000	8,667,626	289,724,819
1922	1,431,349,000	5,293,631	187,496,841
1923	1,774,881,000	10,398,001	194,264,371
1924	1,700,548,000	6,451,713	206,279,758
1925	1,757,858,000	4,621,388	147,762,615

NOTE: Imports and exports are for the year ended June 30 from 1879 to 1919, and calendar year from 1920 to 1925.

**PRODUCTION OF MILK POWDER, SKIM MILK POWDER, MALTED
MILK, AND CASEIN**
(Bureau of Agricultural Economics)
Thousand pounds—000 omitted)

Year	Milk Powder	Skim Milk Powder	Malted Milk	Casein
	Pounds	Pounds	Pounds	Pounds
1916	2,123	16,463	11,654	8,422
1917	3,129	22,624	13,852	8,342
1918	4,154	25,432	15,623	8,676
1919	8,661	33,076	17,136	13,925
1920	10,334	41,803	19,715	11,526
1921	4,242	38,546	15,652	8,076
1922	5,599	40,617	13,659	6,927
1923	6,560	62,251	15,331	14,348
1924	7,887	69,219	15,889	20,759
1925	8,931	73,317	18,050	16,660

CANADA

NATURAL CONDITIONS—The land area of Canada is 3,729,665 square miles. Agricultural crops cover 58,809,280 acres and 9,694,560 acres are in pastures.

POPULATION—The first white settlers of Canada were French, but the country was already inhabited by Indians. After the country was ceded to Great Britain the French colonization ceased and the British predominated, although many other nationalities have continued to emigrate to that new country. The total population (1922) was 8,788,482, of which 4,436,041 were rural and 4,352,442 were urban. Thus the rural and urban are nearly equally divided.

CLIMATE — The great extent of the Canadian territory makes it practically impossible to describe the climate for the country as a whole in view of the fact that the climate is affected by the Great Lakes, in the central section, the Canadian Rockies, in the West, and the Japan Current in the western coast, and many other modifying factors. Possibly the most potent factor of the climate in its relation to the dairy industry is that the grass season begins about the first of May and extends to the middle or end of October, however, in British Columbia, there is grazing the year round, due to the warm Japan current on the coast.

The rainfall is also varied as it is low in some parts and very high in other parts, but in general the rains are sufficient for the crops and pastures.

GRASSES—There are some variations in the different provinces in the kinds of grasses, hays, and fodder stuffs raised for feeding to dairy cattle. However, the country is not nearly developed and the grasslands are generally much more than sufficient for present needs. The following statement is made of the Province of Saskatchewan and is fairly applicable to the other western provinces:

“With two-thirds of the arable land of the province still unsettled, and with the entire arable area well suited to dairying, it is evident that only the fringes of the possibilities have been touched.” (Canadian Dairying, 1923.)

Briefly the kinds of roughage are given as follows: In some parts of the country native pastures are still quite extensive. Such grasses as awnless brome, western rye grass, timothy, meadow fescue, and redbtop are successfully grown. Of the legumes, either alfalfa or sweet clover may be used in every part of Manitoba, while red clover does well in the eastern part of the province. Sweet clover is coming into vogue almost everywhere. Corn is grown successfully for fodder in at least half of the occupied territory of Manitoba, and sunflowers are being introduced rapidly for silage purposes in the remaining districts. Native hay is very abundant in some parts of the country while there is a supply of straw everywhere. Soiling crops, though little used as yet, may be used to advantage; and last but not least there are plenty of comparatively cheap grains and screenings. While this description is of Manitoba it suits most of the western provinces.

The production of clover and alfalfa hay for the year 1922 was 15,216,600 tons while the fodder crops were estimated at 7,382,150 tons (short).

CATTLE—Soon after the discovery of Canada by the French there were a number of attempts to introduce domestic cattle into the country. Attempts were made at Sable Island in 1518 and again in 1598 but without success. Cartier brought cattle in 1541 but all were probably destroyed or died. The successful importations are given by Ruddick as follows:

"The first permanent introduction of cows into Canada was undoubtedly made by Champlain, at Quebec, in 1608, or 1610. In the record of his voyages, he makes mention of the cutting of hay for the cattle in 1610, and in a map of Quebec, published in 1613, a place is shown where "hay was grown for the cattle." Champlain's colony had a farm at Cap Tourmente with 60 to 70 head of cattle in 1629. Some of these were killed by Kirke on his predatory expedition to the St. Lawrence in that year.

In 1660 the great minister, Colbert, under Louis XIV, began sending representatives of 'the best dairy cows of Normandy and Brittany' to New France.

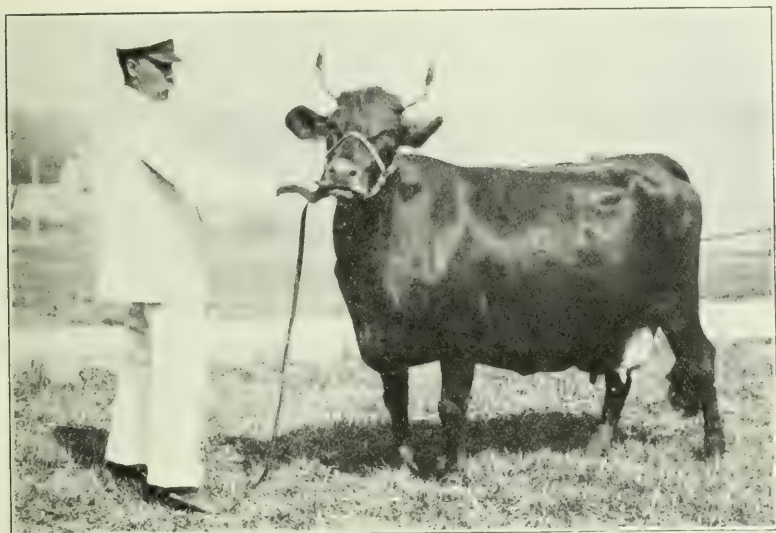
"De Tracey also brought some cattle from France in 1665 along with the famous Carignan-Salieres regiment.

"All authorities agree that the French-Canadian breed of the present day is descended from the stock thus imported from Normandy and Brittany in the 17th century.

"After 1632, when the Arcadian settlements began to acquire a permanent character, more cattle as well as sheep were procured and fruit trees were planted. Fur trading and fishing were to some extent abandoned for agricultural pursuits. In 1671 there were reported to be 866 head of 'horned cattle' in all Acadia. . . .

"After the expulsion of the Acadians from Nova Scotia the fertile lands which they had occupied tempted many settlers from New England who brought livestock with them to the various districts in which they settled. The first

German settlers in North British America came to Lunenburg, N. S., in 1750-53. In 1754, the government 'supplied them with' 74 cows, 867 sheep, 114 pigs, 164 goats, besides poultry.' By 1760 they had 600 cows and were exporting both butter and cheese from the district.



"Canoberte" (5289), a French-Canadian Cow 6 Years Old.

"In 1761 a company of 53 families from New Hampshire, of Irish descent, settled at Truro. They brought 117 head of cattle with them. During the same year a number of Puritans from Connecticut landed at Yarmouth, and they had 267 cattle in 1763, which number was increased to 954 in 1784.

"In 1823 the first cattle were brought into the Red River district and the prairie country—'300 head were driven up from the south (United States) and disposed of to the Red River colonists.' Cattle were noted in the Selkirk settlements, and other cattle were driven up from the Mission Fathers of California."

Mr. Ruddick closes his statement with the remark:

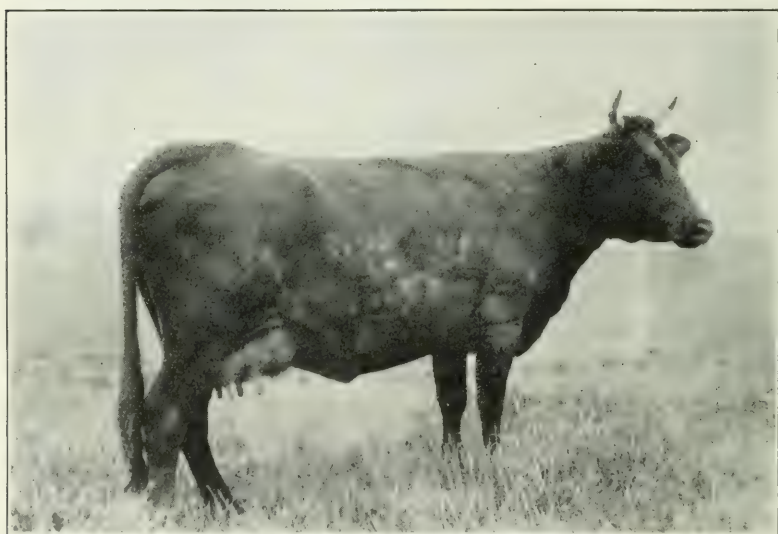
"It will now be evident that Canada may claim the honor of having been the first part of America, north of the Gulf of Mexico or Central America, at any rate, to receive domestic cattle. It is possible that the Spaniards may have brought cattle, as well as horses, to Mexico or Central America, during the 16th century, but the writer has been unable to determine that point definitely."

"It follows that the common cow of this country comes from a very mixed ancestry. In the eastern provinces there is a strain of French or Normandy blood, along with various English and Scotch mixtures and also a trace of Dutch brought by some of the Loyalists, from New York State. In the western

provinces, there is reason to believe that many of the cattle which have come from the south, were of Spanish ancestry."¹

BREEDS—The principal breeds of milk cows in Canada are: Holstein, Ayrshire, Jersey, Guernsey, and Milking Short-horn. while the Red Poll breed is used as a "general purpose" cow.

CANADIAN (French-Canadian)—This distinctly Canadian dairy breed has been developed from the breeds of cattle of Normandy, and Brittany; and is a real addition to the dairy industry. It has been bred pure for many years and no additional imports of these breeds (French) have been received since 1650.



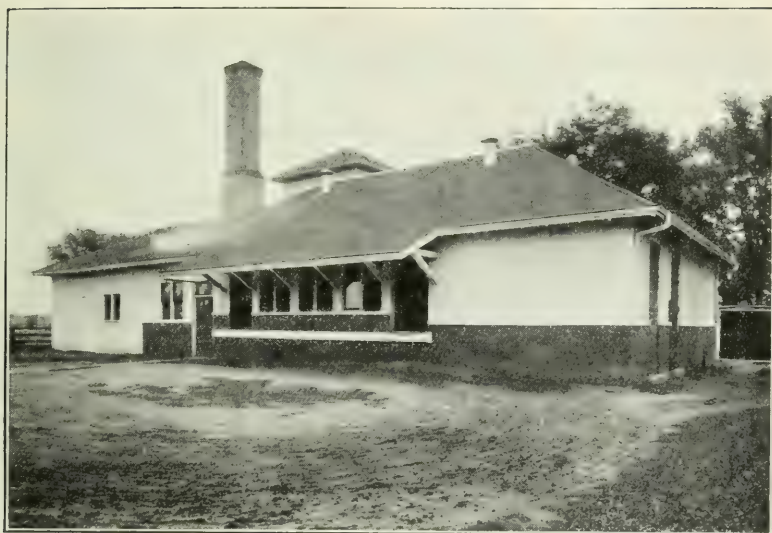
"Presidente De Mastai," a French-Canadian Cow 2 Years Old.

In color the breed varies from solid black to fawn, but a brown skin is preferred with fawn stripes along the back and a gray muzzle. Climatic influences and treatment for two and a half centuries have made some modifications in the breed. It is noted for ruggedness, frugality, a milk rich in fat (4.5 per cent), and a long milk period. Little improvement was attempted until 1880. Some herds average 8,000 pounds of milk per cow a year.

JERSEY—The Jersey breed² was first introduced by Mr.

¹ Dairy Industry, Canada, 1911, J. A. Ruddick, and Canadian Dairying, Department of Agriculture, Canada 1923.

² See United Kingdom for all English breeds.



Farmers' Dairy, Indian River, Ontario.

Courtesy of J. A. Ruddick.

Harrison Stevens, of Montreal, in 1868. In 1871 more Jerseys were imported and founded the St. Lambert family of Jerseys.

GUERNSEY—The Guernsey cattle were not introduced until 10 years after the Jerseys, when Sir John Abbott began imports directly from the Channel Isles. Possibly some animals came in from the United States about the same time.

AYRSHIRE—The exact date of the first importations of this breed is not known but imports were made in 1821, 1845, 1850, and 1853. Enough of the breed was received in these shipments to spread over the dairy district of Canada.

HOLSTEIN (FRIESIAN)¹—The introduction of the Holstein breed had an interesting beginning according to A. C. Hallam, in the *Canadian Dairyman*, 1907:

"Being fully convinced of the superiority of Holsteins and believing that they would make a desirable breed for this country, five progressive Canadian farmers from different parts of the province ventured across the line in 1882 to get some of these celebrated cattle, neither being aware of the other until they reached the quarantine station at Prince Edward Island In the years 1884 and 1885 several importations were made from Holland to Canada by American importers and disposed of at public auction."

¹ See the Netherlands for Friesian breed.

SHORTHORN—While this is not considered a dairy breed, still when special attention has been given to the milk production it does surprisingly well as a milk producer. The first importations for New Brunswick were in 1825 or 1826. There were importations every year from 1832 to 1854 and thus the breed was established.



Manager's House, Farmers' Dairy, Indian River, Ontario.

Courtesy of J. A. Ruddick.

DEVELOPMENT—The development of dairying in Canada has covered all branches of the industry. For 250 years, 1600 to 1850, it improved but little, but when dairying took on new life in other countries it also had an awakening in Canada. The greatest event in this early period was the formation of a new breed of dairy cattle, the French-Canadian breed, which had been produced but had not been improved. About the year 1850 the system of registry of purebred cattle began to be used as a basis for building and maintaining special breed qualities. The first herdbook in Canada was the Canadian Shorthorn herdbook, established in 1867. The first volume of the British-American herdbook was published in 1881 and in 1887 the Dominion herdbook was published. The French-Canadian herdbook was estab-

lished in 1886 and the French-Canadian Breeders' Association was organized in 1896. Modern development began about 1880.

Following the herdbook work done by these associations came the establishment of Dominion Experimental Farm System in 1886 for the grading up of dairy herds and carrying on breeding studies. In 1920 there were 20 stations in 9 provinces and each station or farm maintained from one to four of the dairy breeds.

COW-TESTING ASSOCIATIONS — The cow-testing association system of recording milk yield was introduced in 1904 and in 1911 there were 15,000 cows under test. In 1919 there were more than 2,400 herds having 348 associations and testing more than 22,000 cows in 9 provinces. Quebec had 137 associations and Ontario had 70.

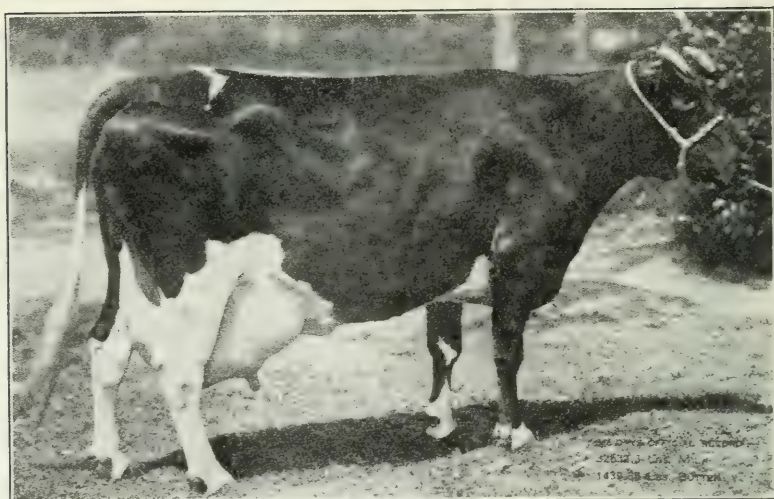
In 1923 the work grew until the number of associations was 710 and the number of cows under test was 50,165. The Dominion Dairying Service assumes all costs of supervision, records, and tests.

TUBERCULOSIS ERADICATION — In 1917 the Dominion Municipal Tuberculosis order was made effective to assist the cities and villages to get pure milk. Regulations were also operative under the Animal Contagious Disease Act, which prohibited the importation of cattle until tested, unless from accredited herds of the United States, with which country there is a reciprocity treaty. It also provides for the inspection and testing of purebred herds.

HIGH-RECORD DAIRY COWS—The development of dairy breeds is shown by the fact that Canadian cows have broken world records several times. The Holstein (Friesian) breed has had the following high-producing cows:

Name	Milk yield	Fat yield	Date
Agassiz Segis May Echo	30,886 pounds	1,345 pounds	1921-22
Balla Pontiac	27,191 pounds	1,270 pounds	1920-21
Dekol Plus Segis Dixie	33,447 pounds	1,686 pounds	1923.

The Canadian record of performance system establishes standards for each of the breeds and up to April 1, 1923, there were 8,029 cows which had qualified as follows: Holstein-Friesian



The present holder of the world's record for milk and butterfat production: De Kol Plus Segis Dixie, 25787. Owned by Donat Raymond, Vaudreuil, Que. Bred in Canada.

Courtesy of J. A. Ruddick.

3,227 cows, Ayrshire 2,541, Jersey 1,316, Shorthorn 653, Guernsey 145, French-Canadian 135, and Red Poll 12.

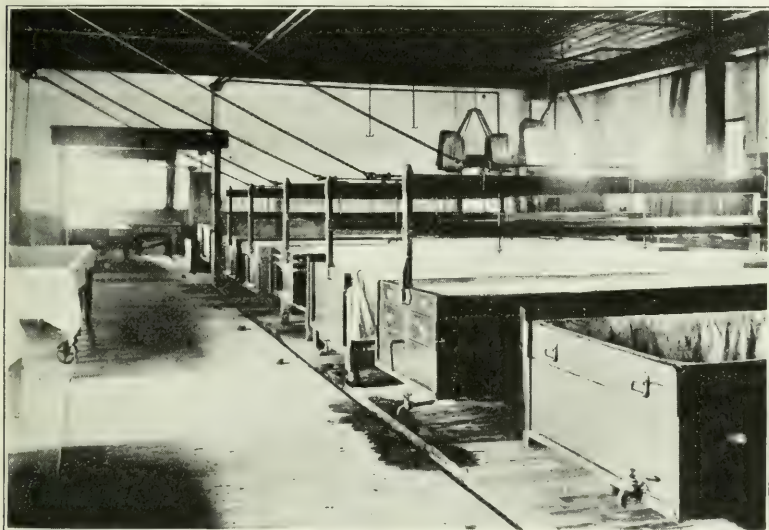
EARLY RECORDS—Reference is made to cheese and butter in many of the records of the settlers in all parts of Canada. French colonists made both. As early as 1801 the eastern provinces were exporting a surplus. In the early 50's the large farms having 50 to 100 cows made cheese. The cheese of George Cross won the silver prize at the Paris Exposition in 1855.

FACTORY SYSTEM—Up to the time of the beginning of the factory system in Canada dairy products were made on farms in the usual pioneer, or ancient methods, little science being used. Most of the product was consumed on the farms and in the immediate locality but the cheese was not quite sufficient for the demands of the country prior to the entry of factories into the industry.

The first cheese factory was established in Ontario in 1864 by Harvey Farrington, and the first creamery was built in Quebec in 1873. In 1865 there were fewer than a dozen cheese factories;

during 1866 60 factories were opened. In 1871 there were 353 factories and 1,565 in 1891.

Most of the cheese made in Canada is of the Cheddar kind, as it suits the factory system and because the English market, to which most Canadian cheese is exported, demands that kind, however,



Interior of Cheese Factory, Ontario.

Courtesy of J. A. Ruddick.

one factory in British Columbia makes a few Stiltons. There have been modifications in the methods of manufacture, as for instance, a change from the "stirred" curd to the use of the curd in the 80's, introduced by Professor Arnold from the United States.

In a report of the Montreal Board of Trade, dated April, 1868, occurs this passage: "The repeal of the treaty (reciprocity between Canada and United States) stimulated the erection of cheese factories which are shutting out foreign trade from the Canadian markets."

The Trappist Fathers brought to this country from France the secret of the manufacture of Port du Salut cheese, and have been making an excellent article at the monastery at Oka, Quebec. It is known as "Oka" cheese. Canada has developed several new kinds



Forfor Factory.

Courtesy of J. A. Ruddick.

of cheese; including "Fromage Raffine," "Meilleur," "Kingston," "Camosun," "McDonald," "Beloeil," "Sooke," and others.

The first creamery was built in Quebec in 1873. The creamery was operated with cream obtained by the gravity system, (Cooley and Schwartz systems) up to the year 1882, when the first cream separator was introduced from Denmark by Lieutenant-Colonel Henri Duchesnay. The factory system became popular at once in these two provinces (Ontario and Quebec). The factories had a kind of semicooperative management. In 1878 S. M. Barre started the first cream-gathering creamery in Quebec. The number of factories increased until 1910 when there were as follows:

Cheese factories	2,291
Creameries	811
Combined butter and cheese	570
Total	3,672

These factories were built principally in Quebec and Ontario, 2,165 and 1,234, respectively. The consolidation of factories has reduced this number of factories and in 1922 there were only 3,095 factories of which Quebec had 1,752 and Ontario has 1,056; hence most of the factories are in these two provinces. The production of these two provinces equals about 68 per cent of the

total creamery butter produced and about 97 per cent of the cheese produced. The production of butter in 1925 was 180,663,783 pounds, and cheese 168,068,894 pounds. There were 27 factories making condensed milk and milk powder. The production of condensed milk in 1924 was 77,230,353 pounds, and for 1924 milk powder 12,548,193 pounds, (recent preliminary figures).



Borden's Plant, Tillsonburg, Ontario.

Courtesy of the Borden Co., New York, N. Y.

The first condensery was built at Truro, Nova Scotia, in 1883. These condensing factories also make milk powder, skim-milk powder, casein, condensed coffee, and cocoa and condensed skim milk.

DAIRY ORGANIZATIONS—The dairy organizations appear to have been started at times of greatest need and have had a large part in the development of dairying. In connection with and through the dairy press they have maintained interest in dairying, supported progressive legislation, and disseminated dairy information. Some of the principal associations are:

Dairymen's Association of Western Ontario, 1866.

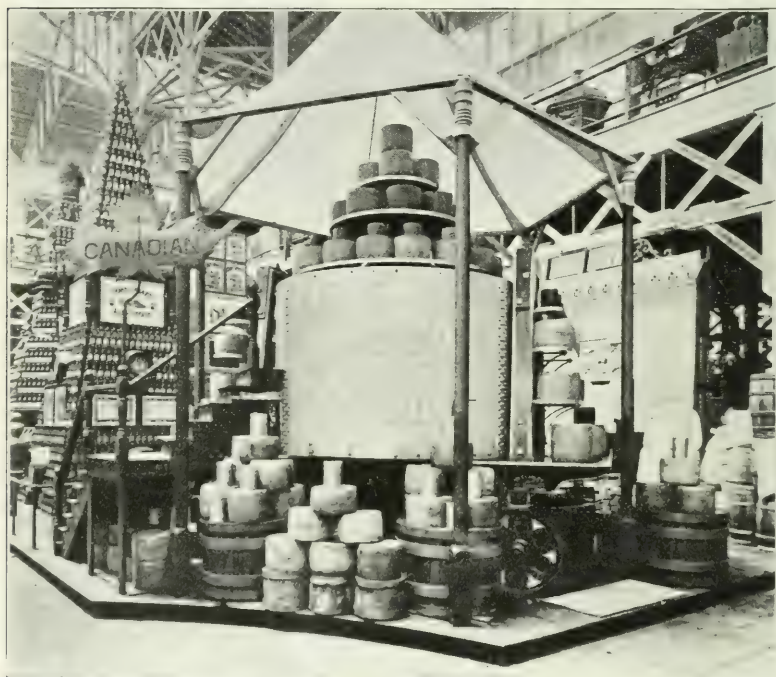
Dairymen's Association of Eastern Ontario, 1877.

Quebec Dairymen's Association, 1884.

Manitoba Dairy Association.
Saskatchewan Dairy Association.
Alberta Dairymen's Association.
British Columbia Dairymen's Association, 1906.
New Brunswick Dairymen United.
Nova Scotia Dairymen's Association.
Prince Edward Island Dairymen's Association, 1899.
National Dairy Council of Canada.

MARKETS AND MARKETING — Canada with its comparatively small population produces a surplus of dairy products. These products were, first, cheese, then butter and condensed milk, while at the present time the surplus covers all the products made in the country, except, possibly, ice cream.

CHEESE—The exports of cheese have exceeded 5 million pounds since 1870, having reached 50 million pounds in 1882, 100 million in 1891, 200 million in 1902, and the highest point



The mammoth cheese from Canada at the World's Fair, Chicago, 1893.
Weight 22,600 pounds. The largest ever made.

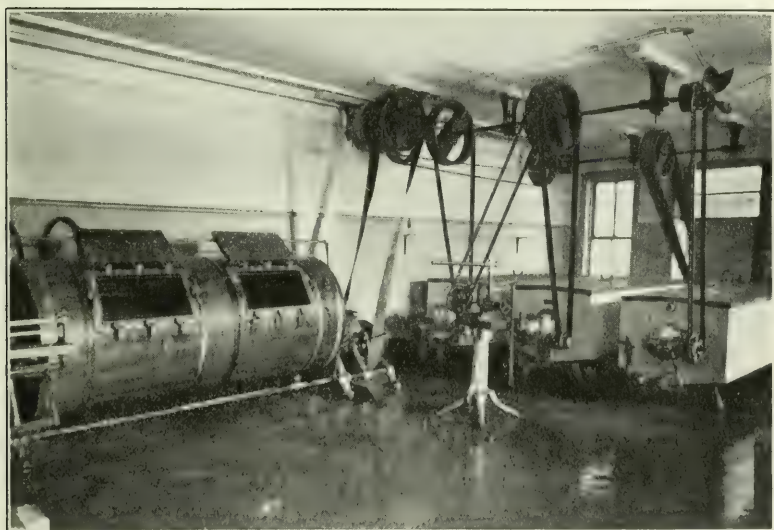
Courtesy of J. A. Ruddick.

in 1904, when the export was 233,980,716 pounds for the year ended June 30. Since that date there has been a decreased export due principally to the increased home consumption but partly to a decrease in the production, the milk for cheese being diverted to market-milk and cream demands. The export of cheese in 1925 was 126,963,200 pounds; and for 1926 (fiscal, March 31) 148,334,000 pounds.

The principal markets for Canadian cheese are the United Kingdom and the United States, in view of the fact that the principal kind of cheese made is Cheddar and the greatest demand for this kind of cheese is among the English-speaking people.

At an early date instructors from the United States were employed to instruct the Canadian cheesemakers.

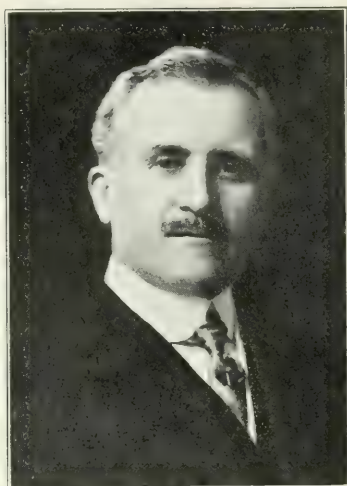
The first shipment of 50 boxes of cheese to England was in 1865.



Farmers' Co-operative Creamery Co., Moncton, New Brunswick, Canada.

Courtesy of J. A. Ruddick.

BUTTER—The production of farm butter in Canada, as in other countries at all times, was not suitable for export; hence the production was little above the local needs. As soon as the factories began to make butter of exportable qualities the prospect



DR. J. A. RUDDICK,
Dairy and Cold Storage Commissioner, Ottawa, Canada.

of such exports became important, but in 1868 there was an export of more than 10 million pounds of butter, which continued in similar quantities until 1882, when it began decreasing and continued to decrease until 1897. The decreased exports were due to lack of quality and to reduced production, which latter was due to competition of the cheese factories.

The export butter is sold principally on the London market but some butter is sold in the United States. The following is quoted from *Farm and Dairy*, February 8, 1923, by J. A. Ruddick, relative to Canada's markets:

"Here are two great markets for Canadian dairy produce, viz., the United Kingdom and Canada, and in one sense the greatest of these is Canada for the reason that Canadians utilize in one way or another fully 75 to 80 per cent of the total milk produced in the country. With regard to prices and values . . . so long as there is a surplus for export the price which is obtained for that surplus regardless of the quantity, very largely determines the price for that which is consumed at home."

DAIRY STANDARDS—During the year 1922 the dairy standards were in force in Ontario for the first time and required milk to be paid for by test instead of weight. The Dairy Produce

Act, effective April 1, 1923, provided for the grading of all dairy products of the Dominion.

The cargo-inspection service at Canadian and British ports



1. The first St. Hyacinthe Dairy School. 2. The present St. Hyacinthe Dairy School. 3. The first Manitoba Dairy School.

was inaugurated in 1901 and has been very beneficial in improving transportation and the handling of butter and cheese.

DAIRY SCHOOLS—According to the "Dairy Industry of Canada," by J. A. Ruddick, the first classes for instruction in the art of cheese manufacture conducted in Canada, if not in America, were held at St. Denis, Quebec, in 1881 and 1882. In 1882 and 1883 classes for creamery buttermakers were held at the creamery at Ste. Marie, Quebec. These two factories received a grant from the Government to enable them to carry on the work.



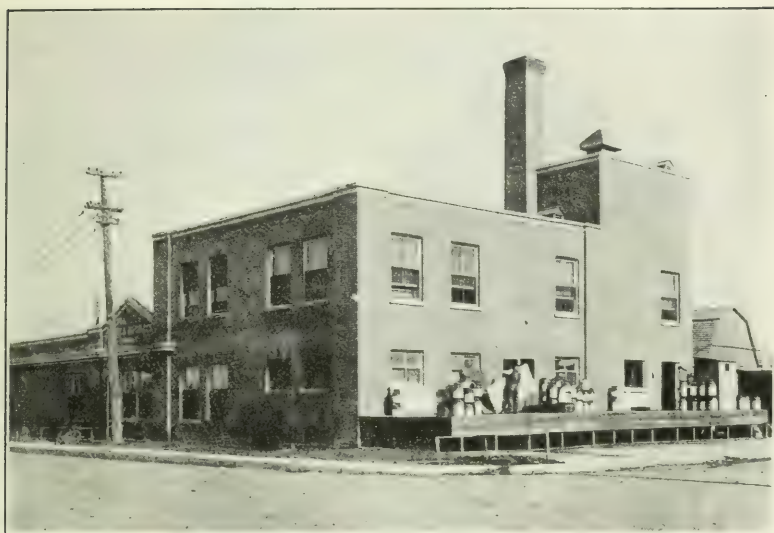
The Creamery Building at Ste. Marie, Beauce Co., Quebec, where the first centrifugal cream separator was used in America in 1882.

Courtesy of J. A. Ruddick.

The Quebec Dairymen's Association, which was organized in 1884, started classes in the Archambault factory, near St. Hyacinthe, that year. The school was finally established at St. Hyacinthe, being built by the dairymen's association and opened November 27, 1892. It was the first regular dairy school in Canada.

In 1891 a school for cheesemakers was begun in Western Ontario.

The dairy school was opened at Guelph in connection with the Ontario Agricultural College on February 15, 1893, with Professor H. H. Dean in charge.



A Creamery in Saskatchewan, Canada.

Courtesy of J. A. Ruddick.

The Kingston school was opened in 1894 with J. A. Ruddick in charge.

The Western Dairy School at Strathroy was opened in 1896. The Provincial Dairy School at Sussex, N. B. in 1894, and a dairy school in connection with the Manitoba Agricultural College was opened at Winnipeg in 1907.

Traveling dairy schools were begun in 1891 by the Ontario Agricultural College in charge of its graduates. In 1894 the Dominion Dairy Service sent out two traveling dairy schools through Manitoba and the Northwest Territories; later they included British Columbia.

Nova Scotia sent out traveling schools in charge of Miss Laura Rose, in 1901.

New Brunswick Department of Agriculture sent out dairy schools in 1895.

EXTENT OF DAIRYING — The number of dairy cows in 1871 was 1,251,000 but the number was practically doubled by 1901—30 years. In 1917 the number had increased to 3,202,000 and in 1924 the number of milk cows was 3,726,985, in

other words, about one-third of the cattle are dairy cows, indicating that Canada is much more in the dairy business than in the beef industry.

BUTTER—The first record of total butter made in Canada was for the year 1871 when the farm butter, which was the only kind, amounted to 74,190,000 pounds. In 10 years it had increased to more than 100 million pounds, and in another 10 years it increased about 10 million pounds more. In 1901 the record for creamery butter first appeared and the quantity made was 36,000,000 pounds, which added to the farm butter made the total amount of butter, 141,410,000 pounds. From that period the farm butter decreased and the factory butter increased until in 1923 the creamery-butter production was 162,835,000 pounds. In 1925 (fiscal year ended March 31) the creamery-butter production was 180,663,783 pounds, while the farm butter is estimated at 100,000,000 pounds. Of this quantity of butter the export for 1923 was 13,000,000 pounds, and for 1925 it was 23,304,000 pounds.

CHEESE—Cheese manufacturing was Canada's first love in dairying. After the United States had built up a fine export trade in cheese with Great Britain prior to the 80's the consumption of cheese in the United States increased and its population increased, which caused the exports to decrease. About that time the reciprocity treaty with Canada, granting free trade on dairy products, was annulled and Canada could no longer accept States' cheese to advantage and was, therefore, compelled to a certain extent to increase her production of cheese. The trade with England became more and more attractive to Canadian dairymen and exports increased up to 1911 when there were exported about 182 million pounds out of a total production of about 200 million pounds. The total production of cheese then began to drop and the farm cheese became negligible in quantity, and factory cheese in 1920 was only 149 million pounds. In 1924 it had raised to a production of only 150 million pounds. The exports in 1926 (March 31) were 148 million pounds, an increase of 22 million over the previous year.

The decreased production in cheese for a number of years was



JOS. CAULDER.
Moose Jaw, Canada.
President of The National Dairy
Council of Canada.

due largely to the beginning of the condensing business and to the great increase in the population together with increased consumption of milk and cream.

The dairy business is so managed that to a limited extent the factories may swing from butter to cheese or vice versa, that is, several hundred of the factories can make either product.

CONDENSED MILK—The first record of production of condensed milk was for the year 1910 when about 28 million pounds were made. By 1920 it had increased to 92 million pounds of which 54 million pounds were exported. There were about 12 factories, part of them owned by United States manufacturers; hence the export to the United States may be largely accounted for, as the product can thus be considered as an export when it crosses the boundary without changing ownership.

OTHER PRODUCTS—The production of cream for shipment to the United States exceeds 4 million gallons a year, while the consumption in Canada is becoming heavier for both milk and cream. Ice cream, and cocoa coffee are made and consumed in large quantities each year.

The dairy industry of Canada is very large when all its branches are considered. The value of the livestock, land, barns, equipment for farms and factories, together with the marketing facilities, schools, colleges, experimental stations, and the occupation of thousands of people engaged in the manufacture or handling of the product in some form and in the caring for the dairy cattle, are some of the important parts of this large, necessary, remunerative industry.

CONSUMPTION—The actual consumption of milk and cream in Canada is not of record but it is estimated that the average is more than half a pint per person daily. The consumption of butter is very high in comparison with other countries. The per capita butter consumption for the Dominion was: 1920—23.61 pounds, 1921—25.79, 1922—26.14, 1923—27.45, 1924—27.21.

The consumption of cheese was: 1920—2.71 pounds per person, 1921—2.51, 1922—3.03, 1923—3.12, 1924—3.25.

CHRONOLOGICAL EVENTS

YEAR

- 1518 First cattle landed at Sable Island by Baron De Lery, but it was not successful.
- 1606 Poutrincourt brought some cows from Port Royal.
- 1608 French founded Quebec.
- 1610 Champlain brought cows from Brittany and Normandy to Quebec.
- 1660 Colbert began sending dairy cows from Brittany and Normandy to New France.
- 1665 De Tracey brought cows to Canada.
- 1763 Canada ceded to England.
- 1813 Lord Selkirk brought cows to Red River district via Hudson Bay.
- 1821 Lord Dalhousie, Governor of Nova Scotia, imported cattle from Scotland.
- 1823 300 cattle driven from the United States to the Red River district.
- 1825-26 The board of agriculture of New Brunswick made the first importation of cattle.
- 1843 The Hudson Bay Company established a post at Vancouver and brought cattle originally from California (mission fathers).
- 1845-50-53 Ayrshires were imported by breeders.
- 1864 First cheese factory established in Ontario by Harvey Farrington from New York.
- 1865 First shipment of factory cheese to England.
- 1866 Canadian Dairymen's Association founded at Maple Leaf, Ontario.
- 1867 Dominion of Canada formed by union of provinces.
- 1868 Jersey cattle introduced by Harrington Stephens of Montreal.
- 1873 First creamery built in Canada, Quebec.
- 1875 First creamery in Ontario—"Schwartz system" (shallow-pan).
- 1877 Dairy Association of Western Ontario and Eastern Ontario founded.
- 1878-81-82 Guernsey cattle imported by Sir John Abbott.
- 1880 Sweet-curd method of cheesemaking introduced by Professor Arnold.
- 1881 The Sprague creamery was started under the "Cooley" system (deep-can).
- 1881-2 First dairy school started at St. Denis, Quebec.
- 1882-3 Holstein (Friesian) cattle introduced into Canada.
- 1882 First cream separator used in Canada.
- 1883 First condensed-milk plant erected at Truro, N. S.
- 1883 Huntingdon district dairymen's association founded.
- 1884 St. Hyacinthe dairy school founded.
- 1885 The creamery association of Ontario founded.
- 1886 The manufacture and importation of oleomargarine, renovated butter, and filled cheese was prohibited.
- 1887 French-Canadian herdbook established.
- 1879-80 Dairy association began work with the industry.
- 1889 Dominion Dairymen's Association founded.

YEAR

- 1890 Hand separator came into use about this date.
1891 Dairy school in Western Ontario founded.
1891 Traveling schools began.
1892 Dairy commissioner authorized to begin a cooperative cheese factory at Perth, P. E. I., and furnish cheesemaker.
1894 Dairy school started at Kingston, Ontario, J. A. Ruddick, superintendent.
1893 Filled cheese manufacture prohibited.
1895 Government established a cold-storage department.
1897 The government paid half the cost of installing refrigerating plants in a number of trans-Atlantic steamers.
1893 Dairy school started at Guelph, H. H. Dean in charge.
1899 Prince Edward Island dairymen's association established.
1903 Renovated butter manufacture prohibited.
1904 Rapid increase in population after that date.
1904 Cow-testing association first established.
1906 Dairymen's association in British Columbia established.
1907 Dairy school opened in Winnipeg.
1914-18 World War.
1917 Dominion municipal tuberculosis order established two grades of milk, tuberculin free and pasteurized.
1923 Butter standards for export butter established, April 1, also for factory cheese.

NUMBER OF DAIRY COWS AND TOTAL CATTLE
(Monthly Bulletin of Agriculture)

Year	Dairy Cows	Total Cattle	Year	Dairy Cows	Total Cattle
1871 ¹	1,251,209	2,624,290	1920	3,530,238	9,477,380
1881	1,595,800	3,514,989	1921	3,736,832	10,206,205
1891	1,857,112	4,120,586	1922	3,745,804	9,719,869
1901	2,408,677	5,327,504	1923	3,659,365	9,246,231
1910	2,853,957	7,104,893	1924	3,726,985	9,460,836
1915	2,666,846	6,066,001	1925		

¹ Data for 1871 included only Quebec, Ontario, New Brunswick, and Nova Scotia.

PRODUCTION OF BUTTER AND CHEESE
(Canada Year Book)
(Thousand Pounds—000 Omitted)

Year	Factory Butter	Farm Butter	Total Butter	Factory Cheese	Farm Cheese	Total Cheese
1871	.....	74,191	74,191	.....	4,985	23,000 ¹
1881	.....	102,545	102,545	.....	3,185	61,000 ¹
1891	.....	111,577	111,577	.....	6,267	109,000 ¹
1901	6,067	105,343	141,410	220,833		
1911	64,698	137,110	201,808	199,904	1,371	201,275
1915	83,991			183,888	²	183,888
1920	111,692	125,000 ¹	236,692	149,202		149,202
1921	128,745	100,000 ¹	228,745	162,117	.....	162,117
1922	152,502	100,000 ¹	252,502	135,821	.....	135,821
1923	162,835	100,000 ¹	262,835	151,624	.....	151,624
1924	182,871	100,000 ¹	282,871	150,273	.....	150,273
1925	180,664	100,000 ¹	280,664	168,069	.....	168,069

¹ Official estimates.

² Farm Cheese Negligible after 1915.

PRODUCTION OF CONDENSED AND POWDERED MILK
(Dairy and Cold Storage Commissioner's reports)
(Thousand Pounds—000 Omitted)

Year	Condensed Milk	Milk Powder	Skim Milk Powder	Year	Condensed Milk	Milk Powder	Skim Milk Powder
1910	27,832	5,324	.....	1921	71,400	1,494	5,619
1917	61,521	3,980	.....	1922	55,139	1,430	5,922
1918	79,808	5,531	.....	1923	78,148	1,325	9,797
1919	85,962	6,591	.....	1924	77,230	1,675	10,868
1920	92,105	7,575	.....			

IMPORTS AND EXPORTS OF BUTTER AND CHEESE
(Trade Commerce)
(Thousand Pounds—000 Omitted)

Year	Butter		Cheese	
	Imports	Exports	Imports	Exports
1871 ¹	2	12,261	60	5,828
1880	127	18,535	107	40,369
1890	381	1,952	128	94,260
1900	1,098	25,260	301	185,984
1910 ²	389	4,615	663	180,860
1915	2,061	2,725	1,136	137,602
1920	398	17,613	363	126,396
1921	3,742	9,739	551	133,620
1922	6,079	8,431	877	133,850
1923	3,768	21,995	917	114,549
1924	1,558	13,649	1,688	116,777
1925	198	24,502	4,544	126,963
1926 ³	7,029	23,304	6,679	148,334

¹ 1870 to 1900-year ended June 30.

² 1910 and after year ended March 31.

³ Preliminary.

EXPORTS OF CREAM, CASEIN, AND CONDENSED AND EVAPORATED MILK
(Trade and Commerce)

Fiscal Year	Cream	Casein	Condensed and Evaporated Milk
	Gallons	Pounds	Pounds
1911	1,823,821	1,515,172	6,594,828
1912	886,266	1,021,197	4,389,350
1913	820,360	349,865	335,849
1914	1,323,929	270,486	9,339,382
1915	1,895,575	230,045	18,355,975
1916	1,262,280	50,564	13,247,834
1917	803,498	50,588	15,858,622
1918	585,601	16,200	43,656,718
1919	485,015	9,110	50,786,856
1920	795,780	.....	54,247,498
1921	1,279,195	.....	49,147,541
1922	1,671,678	23,615	33,133,471
1923	1,712,241	20,060	26,417,300
1924	2,783,866	30,476	44,128,400
1925	3,384,186	120,505	40,052,600

Year Ended March 31.

SECOND CHAPTER

EUROPE

UNITED KINGDOM

Wonderful cattle, climate, and soil; people steady and industrious, but her great markets for dairy products are supplied from all the ends of the world.

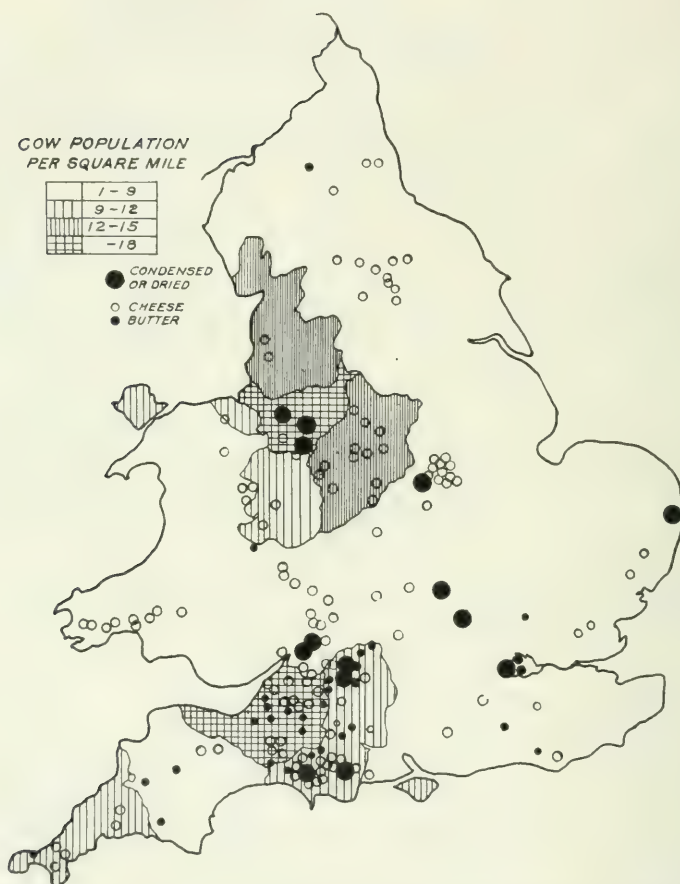
NATURAL CONDITIONS—England, Scotland, and Wales are situated between latitude 50° and 60° N., and have a population of about 38,000,000 (1925). There are many large manufacturing cities in England and Scotland, constituting great consuming centers of the country.

The climate is moist and very changeable; however, the similarity of the climate makes it possible to take cattle from any part to other parts of the country without affecting their characteristics. The fine pastures make the land suitable for the rearing of livestock.

The upland pasture is not extensive but Scotland has some meadows in its rugged sections. The low grazing districts, including valleys and marsh land, are from 50 to 500 feet above sea level and the meadows, in addition to the native grass, have artificial grasses, such as clovers, sainfoin, and rye grass. Other farm-grown feeds have been used from time to time, as chicory, Jerusalem artichoke, prickly comfrey, etc. The pasture is continuous from May to October, but it is necessary occasionally to supplement the grass pasture with cabbage, turnips, swedes, or oil cake, according to the season. In winter also these feeds are used with an addition of malt grains, chaff, barley or other meal, and hay.

In 1896 more than three million acres were covered with clover and ration grasses, while in 1913 there were two and one-half million acres of these grasses. In 1920 there were 13 million acres of rough grazing land entirely uncultivated.

The Channel Isles, Jersey, Guernsey, and Alderney, have a climate which is mild and moist, being very suitable to fine pastures and dairying.



Distribution of Cows and Location of Dairy Plants in England and Wales.

EARLY HISTORY—It is stated that in the earliest history of Britain the Celts, who are said to have had cattle, were pushed back into the more rugged parts of Scotland and Wales by the European conquerors and the cattle of the Celts became the base of the native cattle in Scotland and Wales. These conquerors brought cattle with them and when Julius Caesar took the island many large herds of domesticated cattle were found. Wild cattle were also roaming through the forests. The Kerry cattle of Ireland are supposed to be of the same type as the Celtic cattle.

These various conquests caused the breeds of cattle to become mixed a number of times before records became definite enough to permit tracing the effects of these changes, caused by imported breeds, and it may be added that until a stable government was established there was a continuous mixing of breeds and types of cattle.

The cattle of the Channel Isles are usually believed to have originated in Normandy or come from the Normandy cattle of France. These islands are supposed to have been a part of France at one time. Morse states, however, that the cattle are more like the Kerry and Brittany cattle with possible Norman blood in the Guernsey breed. Since the separation of these islands from France, about 500 A. D., little change has taken place in the nature of the breeds of cattle; however, for more than 100 years there has not been any admixture of foreign breeds, but the development of the Channel cattle has been continuous.

During the Norman Conquest (1066) cattle were carried from France to England. Later there were importations of Friesian cattle from the Netherlands and other breeds from the Lower Elbe and Jutland to England. In fact, all the near-by lands have had a part in the making of the cattle of the United Kingdom, and in turn the English breeds have had a very large part in the making of the dairy cattle of the world.

CATTLE—The characteristics of the breeds of British cattle were not due entirely to the cattle brought in during the conquests. Later imports, especially those made after the year 1600, were largely responsible for the excellent milking qualities of the better breeds. The English breeds, while of many roots, are now quite distinct and have swept round the world and carried with them their fine qualities undiminished.

In 1758 Thomas Hale described the points of a good milking cow in nearly the same language used in 1925 to describe one. After this description he adds:

"The best Dutch and Alderney cows have these short and crumpled horns. they are superior to any other for the service of the dairy. Three gallons at a time is a very fine cow, two gallons is fine, and a cow which gives five quarts at a time is set at the lowest which we consider worth keeping. A cow that yields less than a gallon is to be rejected."

In 1887, James Long made a statement of the presence of foreign breeds:

"Foreign cattle are little kept in England, and almost all the small herds which have been formed have been dispersed or have degenerated on account of the government action preventing importations. Dutch cattle (cows) were at one time used very largely for milk production, while French, Spanish and German beasts were imported in immense numbers for beef. Now the only countries sending live cattle in any numbers are Denmark, Sweden, and Norway. . . . A few (Brown) Swiss cattle are kept in England; the beasts are large, silver-grey in color, slightly too heavy in bone and skin, but very large milkers, good feeders, good for the butcher, and extremely hardy, living where the majority of other beasts would starve. These beasts are extremely profitable and the handsomest of any race in color. French cattle are not bred in England, but the Shorthorn is largely bred in France for crossing upon the Charolais, Cotentin, and Nivernais beast, which it much improves, the government keeping up one pure Shorthorn breeding establishment for the purpose."

Breeds—JERSEY—This breed has a varied gray fawn color and is a native of the Isle of Jersey where it has been bred pure for upwards of 500 years. It is believed that the Jersey, and Guernsey, which were formerly known by the name Alderney, are of French origin—that is, they are a part of the breed that inhabited that part of France when the Channel Isles were a part of France, about 500 A. D., which would make them of Brittany or Normandy. The outstanding excellence of the Jerseys dates back about 200 years and the importation into Jersey of foreign cattle has been prohibited by law since 1763.

The Island of Jersey maintains a total stock of only about 11,000 head, 5,000 being cows. About 1853 a demand for Jersey cattle started in the United States and the island had to take special measures to prevent too many of the better animals from being exported. Another American boom for Jerseys took away, in 1882, a great number of the finer animals.

Jerseys are healthy, well bred, and last a long time. The principal malady in England is milk fever. Bovine tuberculosis is said to be practically unknown in the Isle of Jersey.

Cows of this breed give very rich milk, that is, rich in butterfat, many of them average 6 per cent fat, while the average of all Jersey is very high. A yield of from 12 to 14 pounds of butter a week is common, while the average of the island is 7 pounds of butter per week, from 10 quarts of cream.

The following is taken from an authority living on the Island of Jersey and was written in 1887 for the U. S. Consul: (By Jonathan Smith, Isle of Jersey) :

"Our breed of cattle was originally the same as that of Normandy, of which Jersey forms a part, and with which it was once physically connected. Tradition says that it was severed from the mainland about the same time when the sea swept over the pleasant fields of Kent and buried them forever under the 'Downs,' leaving no trace of what once had been, save the shifting Goodwin sands. Jersey has the same forms of self government, the same land tenures, the same laws and language, the same manners, customs, and habits, and the same cattle that she had 800 years ago. The climate permits her cattle to be out-pastured almost every day of the year. The original stock, Normandy, has been and still is famous for its butter qualities. The farmers have bred for that single object and the Jersey has been brought to its present perfection by following this single object—butter. Hence it has been the inevitable custom for ages never to use a bull without seeing his dam and being satisfied as to her yield of butter. Unless this proved satisfactory no other point in the bull or his dam would avail anything; nobody would use him. This idea still governs the vast majority of our breeders. . . . It must be regretted that some English breeders have recently (1887) set up standards—solid color, which has no foundation and is but an odd caprice, a blind alley leading to nowhere.

"There are two peculiarities in the management of Jersey cattle on the island—tethering the cows, and feeding the calves by hand. These doubtlessly originated as a matter of necessity, and has since been continued as an economy. Owing to the small size of Jersey farms, which has constantly divided at the death of the owner among his children and the necessity each farmer felt, in the olden time, to raise as far as possible all the necessities of life for himself, each farm has its patches of wheat, turnips, grass, cabbages, etc., growing side by side, often all in the same field. Hence the necessity of confining the cow in some way to keep her from damaging the crops. . . .

"The Jersey calf is never allowed to suck at all, and has, therefore, never to be weaned. The rearer has perfect control of the calf's food and can vary it as needed, and it also increases docility. The effect on the cow is good. Having never yielded her milk to other than hand milking she does not hold up her milk."

The average number of Jersey cattle exported from the island is 2,000 per year.

GUERNSEY—The Guernsey is believed to be an offshoot of the Normandy or Brittany cattle, the same as the Jersey breed. It is larger and stronger boned and otherwise more robust than the Jersey. This breed includes the cattle of Alderney, Guernsey, Sark, and Herm. The importation of live cattle to the island, except for immediate slaughter, is forbidden by law. In their homeland the breed is very docile, well cared for in sheds in the winter, and almost invariably tethered in summer on the grass.

The color is irregular yellow or orange and white. The butter, like the cream, is rich in color. A yield of milk of 8 quarts a day is a good average but some go as high as 20 quarts or more for a short period. The milk is rich in butterfat and the cows milk throughout the year.

Two herdbooks have been founded, one for form and the other for register.

The number of cattle on the Island of Guernsey in 1920 was 6,254 head, of which 2,327 were cows.

SHORTHORN—The milk strain of the Shorthorn cattle had its origin in England, possibly near the middle of the 17th century. The native cattle, although very much mixed, had at that time received some attention and development had begun. In some sections the cows were more noted for the size and milking qualities than in others. Two records of origin appear—one in Holderness (East Yorkshire) and the other in Durham. About 1640 a bull and some Friesian cows were brought into Holderness from Holland. These cows were excellent milkers and were large and coarse of body. They were esteemed valuable for crossing with the native cattle on account of size and milk yield. Holderness was a great grazing district and soon the cattle became renowned for milk and were called the Shorthorn breed.

The other source of origin of the Shorthorn breed was the Durham district, in the Tees basin. About the same time, 1640, or a few years later, there were introduced into Durham Dutch cattle which were crossed with the Tees cattle (Durham) giving rise to the Teeswater Shorthorn, or Durham breed. At still later dates bulls were imported from the Continent, principally from Holland.

The breed spread quickly and multiplied rapidly. About 1754 the Collings Brothers began applying the Bakewell principle of selection in the breeding of the Shorthorn, a step which produced most important results, improving the frame and proportions of the cattle, and largely developing and increasing their milk and fattening properties. The Collings herd was dispersed in 1810.

The principal color of the breed varies from "a white to a yellowish tinge of white, some are red, others red and white, and occasionally the white and red are blended, forming a beautiful variegation called roan."

The Shorthorns are probably the most propagated of all milking breeds in Great Britain, although scarcely known beyond the valley of the Tees before the commencement of the present century. They flourish in all parts of England and in the lowlands of Scotland; in fact, it is well-nigh impossible to single out any part of England where prominent herds of this breed are not to be found. Ninety per cent of the dairy cows supplying milk to London at the present time are of this breed. The herdbook was founded in 1875.

None of the champion Shorthorns of Smithfield have been eligible to register. That is to say, no purebred ever took the sweepstakes at the Smithfield shows.

DEVON—The Devon breed of cattle can be traced back into history until it is lost. Youatt deems it one of the best existing representatives of the original British breeds of cattle. This breed is considered a beef type and, therefore, is not noted for its milk production but the milk is rich in fat and other solids. The cattle have had a good reputation as grazing stock for many years. The breed has a number of types but all come under the general head. It is specially noted for beef and although other breeds have been introduced into the region of Devonshire they have failed to supplant the Devons in their original home. The Devon Cattle Breeder's Society was founded in 1851.

Francis Quartly, of Great Champson, was the principal developer of the breed.

HEREFORD—This breed may be said to have arisen contemporaneously with the Smithfield Shows. It is a beef breed but

it is claimed that with slight crossing with the dairy Shorthorn brings out large milk production. The origin of the breed is uncertain but it has been noted for more than 100 years. A noticeable feature is that crossings of this breed are said to carry the markings until it has sunk below one-fourth blood.

LONGHORNS—This is an old breed and is generally liked for its milking qualities. The breed seems to have originated in Ireland or in Yorkshire. The color is dark red, brindle, or pied, and the long horns of the breed grow forward and hang down. While the Shorthorns are better milkers it has also been known that Longhorns can be greatly improved and it is possibly for this reason that they were so highly esteemed by Bakewell. It was the prevailing breed in Ireland until supplanted by the Shorthorns. The Longhorns could be traced back for 200 years in Ireland.

GALLOWAY—The origin of the Galloway breed is obscure but it undoubtedly is a very old breed, and it is claimed that it has existed in a pure condition in its native district from the beginning of the 17th century. The home of the breed is the district in the southwest of Scotland which bears the old name of Galloway. This is a beef breed. It was originally partly horned and partly polled but by selection it has become polled.

HIGHLAND—This breed is from the western Highlands of Scotland and the cattle were formerly known as North Argyleshire. They are somewhat small, thick skinned, with long, glossy hair of varied color—red to black, dun, yellow, or brindle. They are celebrated for their grazing abilities, and “meat down to the heels.” It is a beef breed. Their hardy nature does not require that they be housed and they feed on the poorest pasture where even sheep would hardly stay. Much attention was given to their improvement about 1885. For dairy purposes they do not rank high because the milk, though rich in fat, is not abundant in quantity.

The breed is remarkable for its fine appearance.

“When in finest bloom the Highlander is indeed a perfect picture; and that is generally in the three last months of the year. The coat of hair is then at its best, and the bull looks every inch a monarch prepared to wrestle and fight with the north wind. Possibly in the richest pastures of the Lowlands he would not look so well, still at all times he looks by far the most noble of the bovine race. For parks, therefore, he is in good demand, and it is

possible that he may find a home in every demesne where his picturesque appearance becomes well the wooded country."

This breed matures at about 5 years, cows weigh about 700 pounds, and bulls about 1,000

RED POLL—The origin of the breed is debatable but the root is the old Suffolk cow. This breed is a dual-purpose breed, producing beef and milk.

The history of the Red Poll cattle traces them back to the last century. Suffolk has from time immemorial bred polled cattle, producing butter which as early as 1734 was claimed to be "esteemed the pleasantest and best in England." In 1778 these cattle were in existence from the northern boundaries of Suffolk to the center of Norfolk. Much is claimed for the quality of the meat.

The first cross sired by a polled bull is always red and polled, no matter what kind of horned cows are used. They are good rustlers and thrive on scanty pasture. Their milking qualities are specifically important on account of the tendency not to go dry but to hold up the milk flow from one calving period to another.

The Red Poll or Norfolk and Suffolk is a dual-purpose breed formed about 1846 by the blending of two types—the old red Norfolk horned and the Polled Suffolk duns—of very different type and character. The latter (Polled Suffolk) was a milking breed of conspicuous merit.

The present Polled breed is crossed with the Galloway cattle.

The herdbook was established in 1873-4. The following is from the Royal Agricultural Society Show, 1886:

"The improvements made during the past few years in the style, substance, and quality of the animals as well as the advance toward uniformity of type, is within measurable distance of miraculous."

Yield: Arthur Young says the Old Suffolk cows produced 80 pounds of milk a day. Possibly the yield now (1915) is not over 60 pounds but it is richer than formerly.

POLLED ANGUS OR ABERDEEN ANGUS—This breed is supposed to have descended from what was called "polled dod-dies," or "Aberdeen hummlies." They are black in color, and glossy, make fine show animals but are not good milkers—a distinctly beef breed.

The first great improvement was made by Henry Watson, 1808, although they had existed in the district undeveloped since the 16th century.

SUSSEX—The Sussex breed is a beef breed and was originally used in the place of horses. They resemble the Devons and are likewise not good milkers. This is one of the largest of British breeds. A famous Devon ox of Burton Park, Petworth, is said to have been 16 ½ hand high and weighed 4,022 pounds.

WELSH (Black)—The Welsh Runts, as they are sometimes called, may be considered as an aboriginal breed, but they have varied much in quality. They are apt to be somewhat ragged in outline, though fairly good specimens are occasionally to be found. The color is usually black with sometimes a little white. They are good for dairy purposes but are usually too strong in bone and hide for fattening but in the hands of good breeders they have become as refined as other breeds.

This breed is supposed to be allied to the Chillingham Park cattle and to the Devons. They have horns and always run in the open. A yield of 14 pounds of butterfat a week is considered to be an average. The butterfat test of the milk is from 4.5 to 4.8 per cent. It pays the Welsh farmer to keep this breed even on poor ground and though poorly fed, for it is asserted that three Black cattle can be kept on the same food required for two Shorthorns.

The Welsh cattle herdbook was first published in 1874.

KERRY—The Kerry cattle are the most noted breed that is native of Ireland. The cows are good milkers for their size. From the ease with which they are kept in limited space they are sometimes called "the poor man's cow." They are small, handsome, black, and docile. Frequently the animals do not exceed 40 inches in height. They are noted for hardiness, but it is said that crosses with Shorthorn are less and less capable of caring for themselves on poor pastures. Good Kerries when at their best give 7 ½ quarts of milk a day. (See Ireland for further history of the breed.)

AYRSHIRE—The Ayrshire breed as such originated in the northern division of the county Ayr, Scotland. There is clear evidence of very similar cattle being there in fair numbers about

the middle of the 16th century, but it is unlikely that the breed was really native of the district, and it is highly probable that it descended from imported cattle, likely of the Dutch, the Teeswater district, and to a much less extent, from the Channel Islands breeds.

This breed has been considered one of the newer breeds; still it has been in existence more than 100 years. There are records of the breed in 1793, and in 1812. At an earlier age the cattle were known as "Dunlop breed," possibly from the parish of that name. Being bred for the purpose of milk production has caused the present excellence in that quality.

This breed was brought to the attention of breeders by the National Agricultural Society, first in 1826, when prizes were offered to encourage breeding of fine stock. In 11 of the counties they were the only kind of stock. Large exportations of them were made about the year 1877 to Sweden, Australia, New Zealand, and America, as well as lesser numbers to other countries.

The breed takes its name from the county Ayr, Scotland.

The color of this breed is usually red and white, or brown and white, in large patches, or all red and brown, but sometimes black and white. Professor O. E. Reed, of the Michigan agricultural college, states that he saw in Scotland one purebred herd of Ayrshire cattle which were solid black and very handsome.

Ayrshire cattle will bear almost any variation in climate and thrive in high-lying districts without loss of milking properties, while a milder climate and rich pastures suit them perfectly. The breed is exceptionally hardy. Most breeders allow the calves and heifers to lay out all winter. When a roof is used they are permitted to go into the open as much as possible. The cows are very intelligent and at the appointed hour for milking they will be "waiting at the gate."

The breed is very popular in Great Britain, partly because it suits the adopted system of farming better than heavier cows, as the cattle are generally restricted to the arable portion of the farm, the land being kept in artificial grasses 2 years at a time that dairy cows may be kept.

Milk cows, as a rule, are on grass in summer for 5 months but some are fed a little bean meal at milking time. In winter milk cows require warm feeding, cut hay boiled with turnips; but bean meal is the most common feed.

Some say that the breeding has been done for milk production and none for body development and that there is now a reaction against such practices. Bulls are seldom kept after 5 years, except for show purposes, and by the time the 3-year old heifer is in milk and proves her excellence, the bull is dead. This is undoubtedly a serious mistake.

Calves receive milk two months, then grass; in winter, once a day, they are given hay or straw laid down on clean pasture land with probably a little oil cake.

Twelve pounds of butter a week and 400 a year are good averages for a cow. A herd which averages 11,000 pounds of milk a year per cow is a good herd.

The chief objection to the breed in England is that the beef value is so low after milk ceases and the animals are ready for the block.

PARK—Park cattle are both the oldest and the youngest of the British breeds, the oldest in that they are the direct descendants of the gigantic wild bulls which once roamed through the British forests, and the youngest in that they made their first appearance in the ring of the Royal Show in 1920. The Park cattle herdbook records all animals in existence in 1918. There are two varieties, horned and polled. While they are classed as dual-purpose cattle the cows yield as high as 10,000 to 12,000 pounds of milk even on poor feed.

THE BLUE ALBIONS—One of the lesser breeds which is found in the highlands of Derbyshire. The cows are good milkers.

BRITISH FRIESIAN—This breed, as the name implies, is distinctly Friesian and similar to the same breed in the Netherlands and in the United States. There were importations into Great Britain of Friesian cattle in the 17th and 18th centuries and possibly one of the heaviest importations was between 1870 and 1880. These cows yield a large quantity of milk as in other countries. As the breed is well discussed in other chapters no further comment here is needed. (See Netherlands, United States, Argentina, etc.)

SHETLAND—Perhaps the least known cattle in England are the Shetland cattle. The breed is almost all in the hands of one

nobleman, Marquis of Londonderry. When the cows are well fed they are good milkers and the milk is rich. They are used mostly for the nursing of calves and the cows often nurse two calves each. Their native home is the Shetland Islands. They are very hardy, as would be necessary to withstand the climate of their native land.

Period 1631 to 1784—MANUFACTURE OF CHEESE—The manufacture of cheese in this period was the result of centuries of cheesemaking and, whatever the beginning may have been, the cheese had attained character, quality, and reputation. The various kinds were well established and it is also well known that the women made all the cheese and the only instruction was that handed down from mother to daughter. Men were seldom used in cheesemaking but when they were used it was for the purpose of lifting and turning the heavy cheeses. A common saying was, "What does a man know about cheese?"

As late as 1784 F. Twamley, in his book entitled "Dairying Exemplified or Business of Cheesemaking," states that:

"No treatise or book of rules or methods of manufacturing cheese, hath ever been attempted. That general way that the art of dairying has been carried on for ages, has been traditional, for common and continual experience, naturally adopting from time to time the methods that appear best from such as have happened to come within their own knowledge without ever calling in the assistance of philosophy by which they might learn the different qualities and effects of methods they use, of knowledge how to apply them in physical and practical manner."

Mr. Twamley's discussions of the conditions and methods of that period from the middle of the 18th century to the close are interesting in that they indicate that some of our most dependable methods of today were then in actual use; and though crudely applied the methods were fairly complete; however, the reasons for success were largely unknown; a portion of his discussion is as follows:

CHEESEMAKING—"Runnet, rennet or corning to be put in when it is milk-warm. Not the warmth of the cow but a term well understood.

"Salt cheese, about two handfuls to 10 or 12 cows' milk.

"Cheese never tastes agreeably until it has had a sweat.

"The sweat of the cheese should not be rubbed off as it keeps the cheese soft and improves the flavor.

"Cows being driven too great a distance to be milked causeth the milk to heat.

"Carrying the milk on horseback or in churns I take to be still worse.

"Skim cheese is much used on shipboard as it keeps better and is cheap.

"Coloring cheese has become universal—mostly annatto. London the best market."

BUTTER—"Whey butter was well known. Coloring winter butter to resemble summer butter.

"A barrel churn preferable but pump churn used."

METHOD OF PASTEURIZATION: "In the first place they deposit their milk in earthen pans in their dairy house in the summer (after they have stood 12 hours in summer and double that time in winter) they remove them to stoves made for the purpose, which stoves are filled with hot embers; on these they remain till bubbles rise, and the cream changes color; it is then deemed heated enough, and this they call scalded cream; it is afterwards removed to the dairy where it remains 12 hours more, and is then skimmed from the milk and put into a tub or churn, if it is put into a tub, it is beat well with the hand, and thus they obtain butter; but a cleaner way is to make use of a churn; some scald it over the fire, but then the smoke is apt to affect it, and in either case if the pans touch the fire they will crack or fly, and the milk and cream be wasted."

NEUTRALIZATION—Mr. Hazzard, who wrote the portion of Mr. Twamley's book relating to butter, recommended the neutralization of cream as an aid to the churning of old cream in winter. He observes that "when the operation of churning had been going on for half a day he caused a little distilled vinegar to be poured into the churn and the butter was produced within the hour afterwards. (A teaspoonful of vinegar to a gallon of cream.) Lime and soda were also used."

Fishy flavor was common and thought to be due to the fat having been melted in the cream or in the butter.

Milk was generally contracted for the summer and for the winter with the winter rate higher.

The condition of the industry in England is given by the same author in part as follows:

"We find many farmers industrious to improve their cattle, and set much store on blood and fashion. It is well known by people who keep one or two cows that there is a material difference between cows not only in the richness but in the yield of milk.

"The business of dairying is of considerable importance and what is in some places half, or nearly the whole income, or products of the farm.

"We often hear of Cheshire dairies of 100 cows each.

"Dairies produce annually about 300 pounds of cheese from each cow, as an average, but some few produce 500 weight from each cow.

"In North Wiltshire there are dairies that make 25 tons of cheese in a year and a few more than that."

This statement from Mr. Twamley has been given quite fully as it claims to be the first book of rules for the manufacture of butter and cheese in England, also because it gives some idea of the extent of the industry at that time.

Mr. Twamley's appreciation of the dairy cow was also well stated:

"A cow may, I think, justly be styled the most useful of all animals in regard to man; milk is a support to our infancy and greatly contributes both to our comfort and support through life, not only supplying our present wants by that salubrious aliment, but our future wants not only at home but abroad; by the cheese and butter produced from it. It supplies us even with many luxuries in our taste, is a great support to weakly constitutions by its veal; as well as a great support in the article of provisions, afforded when alive; when dead, is to us the great stamina of our food, beef, being the most nourishing and agreeable repast; it not only supports us at home, but supplies our fleets, our armies, our garrisons, and islands all over the world."

One of the crudest of churning processes is described of this early period as follows:

"The farmer pours the cream into a cloth, neither too thick or too thin, the corners are gathered together and fastened securely, so that nothing comes in contact with the cream. The whole is then buried in the earth at a depth of 7 to 12 inches and taken out at the end of 12 hours, when the cream will be found quite firm. It is worked, a little water having been poured over it, and the buttermilk immediately separated from the butter. The operation is said to furnish butter of excellent quality."

DEVELOPMENT—From 1880 to 1885 more attention was given to dairying than in 25 years preceding that period. The factory system had been adopted and by the end of the period wholesale co-operative milk-distributing associations were organized to supply the large cities with milk. This period (1880-1885) is referred to as the "five oppressive years." Agriculture at that period had three kinds of farming with different results—corn (grain) farming, dairy farming, and mixed farming. In nearly every case during the 5 years the dairy farm had paid its way, or perhaps paid a large profit, while the corn (grain) farm had lost heavily, and on the mixed farms the dairy had been the salvation of the farm.

Naturally this would cause a shift toward dairying, and this

shift was due to a number of things some of which are as follows: The land had been used largely for the production of wheat, corn, beef, and mutton and the competition from abroad, principally from the United States, made each of these products much cheaper and, therefore, less profitable to the British farmers. They naturally turned to other lines of farming. Unfavorable seasons, increased burdens on the lands, and the insecurity of tenancy also contributed to the dissatisfaction with their farming activities.

Long says of that period:

"If, as is argued, we can not compete with America in the price of wheat and beef . . . why should we not endeavor to produce milk for the consumption of our town people, and compete with other countries in the manufacture of butter and cheese. Milk and butter almost always fetch remunerative prices . . . in many parts of the country milk often can not be obtained, fresh butter is comparatively unknown during several months of the year, and the best English cheeses are not to be had at all. Not only is this true but inferior articles are largely imported and sold throughout every one of our great centers of population at prices which should amply repay the English producer . . . It is strange that for years our leading agricultural societies have strained every nerve, devoted large sums of money and plenty of energy, to introduce and perfect machinery to encourage the manufacture of artificial manures and improve the breeds of beef cattle, but have scarcely given a passing thought to the milking cow or to the manufacture of butter and cheese. Now, however, it is all changed. Associations have been formed, demonstrations are conducted, etc., and it is evident to every person connected with agriculture that a great dairying movement has commenced, and have recognized its importance."

The following statement gives a description of the conditions in England about 1885, just before the interest in dairying began:

"The largest farmer in one district had 800 acres of land and kept 10 Shorthorn cows. He made butter for market, and fed the skim milk to pigs—which same milk obtained by the separator or Cooley system, would prove most acceptable to the nearest town or village, for the cottagers seldom see milk in any form. The dairy is conducted as it was 40 years ago; the calves sold at birth, and the cows brought in and sold after the 5th calf. The smaller farmers each kept one or two cows of an inferior type, and the gentleman kept a fancy herd, but used most of the milk to fatten calves. Cheesemaking is not a specialty to the British farmer. He has been so long accustomed to leave the dairy and the hennery to his wife that little advance has been made. Very little of the country butter reaches the larger cities but they are supplied by imported butter."

In the year 1885 special fast trains on most lines of railroads delivered milk to London in a few hours after it was milked, both morning and evening.

Some of the farmers had cows from which 480 pounds of cheese was produced a year. Cheesemonger shops increased rapidly in London and all the imported cheeses from many countries were to be bought in their shops.

After the year 1894 the dairy industry of Great Britain grew steadily until the World War and dairy farming, to a large extent, took the place of other types of farming. This may be accounted for in part by the increased use of milk, which is becoming more and more a part of the natural diet of adults as well as children in Great Britain. In 1913 it is claimed that 15 per cent of the food bill in Great Britain was paid for dairy products.

The average production of milk for the period 1909 to 1913 less that fed to calves, is given as 1,231,000,000 imperial gallons, and for 1919 as 1,085,000,000 gallons, and 1923—1,350,000,000 gallons. There are estimates for the year 1885 but the estimate is unquestionably too high.

Great Britain is fortunately able to produce, at the present time, a supply of milk sufficient to meet her requirements for market milk. In 1900 a large quantity of milk had to be imported. Milk selling has been described as the sheet anchor of the English farmer. He realizes his freedom from competition from imports that exists in most other commodities. Domestic butter and cheese have to compete with various parts of the world and the cost of production in most countries is much less than in Great Britain.

Numerous dairy farmers in England do not raise their own stock but buy cows which are retained for 1, 2, or 3 years and then sold to the butcher. To such farmers milk records and good breeding do not appeal.

FACTORY SYSTEM—The introduction of the factory system into England was due largely to the efforts of Lord Vernon, Mr. J. Y. Crompton, the Honorable Edward Coke, and Mr. H. M. Jenkins. The factory system, especially for butter production, was very slowly adopted in England and Scotland, as the market milk branch of the industry was more profitable, and as much attention was being paid to the raising of beef cattle and veal calves prior to 1880; but from that date there was a decided change toward the system.

Three types of churns were in use in 1880, the swing churn, the box churn, and various modifications of the barrel churn.

The factory system of dairying in Great Britain is not extensive, especially in England, where the large centers of population require the milk for consumption. Where these factories do exist they usually are engaged in all branches of the industry, selling milk to towns wherever possible, and making cheese and butter of the surplus milk. These factories are found chiefly in the isolated districts. The greater part of the butter and cheese was still produced on the farms but even this is rapidly giving way to the production of market milk. While the first quality of butter and of cheese are produced on farms and the bulk of the production compared very unfavorably with the cheese made in factories.

γ **BLENDED BUTTER**—In Great Britain butter blending is a large business, thousands of tons being blended each year. This is a process of mixing butters of different grades for the purpose of disposing of the lower grades of butter and to secure a uniform product. In 1912 it is estimated that 40 per cent of the total butter consumed was blended, approximately 250 million pounds. It is asserted that the uniformity of Australian butters has not been maintained but that the flavors of Australian and New Zealand butter are very desirable for blending. The sale of margarine causes a poor sale of the low grades of butter and this also encourages blending. The texture of blended butter is defective.

Butter consumption in the United Kingdom for the period 1909 to 1913 was estimated as averaging 15.3 pounds per person. although it was also estimated that in 1903 the consumption was as high as 18½ pounds.

MARGARINE—Margarine (oleomargarine, nut margarine, butterine) is the principal substitute for butter. The total consumption of margarine, including imports, amounted to more than 500 million pounds a year in the period 1909 to 1913. In 1894 a large factory was constructed at Southall, England, in which 1,000 persons were employed in two shifts, day and night, producing 1,000 long tons (2,240 lbs.) weekly. This was one of the largest factories in the country. During the World War a number of factories were built to make margarine to replace butter, which could not be imported. The quantities of margarine produced by these factories were enormous. Since the war these factories have consolidated and reduced their output. The imports of this product from Netherlands are still rather heavy.

Margarine Production (Commerce Report)

<i>Year</i>	<i>Pounds</i>	<i>Year</i>	<i>Pounds</i>
1913.....	174,720,000	1917.....	404,768,000
1914.....	174,720,000	1918.....	530,682,000
1915.....	258,469,000	1919.....	728,582,000
1916.....	288,754,000		

FEEDING—Method of feeding in 1921, as described by Professor James Long, of the British Dairy Farmers Association, is as follows:

"Milking cows are chiefly fed on pastures in summer and upon hay, straw, roots, concentrated cakes and meals in winter. The average Swede crop which fell to 1,848 pounds per acre in 1919 averaged less than 2,556 pounds, which quantity is insufficient to cover the expense it involves if it is cultivated at all. For nearly 20 years it has been demonstrated on hundreds of farms that by manuring with mineral fertilizer or the adoption of a special system of seeding, such as that known as the Elliott system, a much greater weight of richer herbage can be grown even upon poor soil."

According to a price-cost survey in 1921 a dairy cow is kept in the herd but 3 years on an average. The cost is relatively a personal matter as one man will make a profit on poor land by liming and proper use of slag and a careful management of pasture, while less profit is had for much better land by another farmer. There were for 1920 approximately one cow to 15 persons in England and Wales combined.

USE OF CHEESE — All the principal British cheeses in use were perfected many years ago. In fact, it is hard to find records of any time in English history when cheese was not a prominent part of the diet. These cheeses were originated while the cheese-making was in the hands of the "lady of the house" and in the hands of the milk and cheese maids. The early history, at least back to 1600, speak of the woman only as the one who did the milking, buttermaking, and cheesemaking; in fact, she had the care of the cheese and sale of butter and cheese at the market. The annual fairs made a special feature of butter and cheese contests, and the woman who carried off the first prize was, indeed, proud of the honor.

Stilton, Cheshire, Cheddar, Gloster, Derby, Dunlop and Leicester are the principal kinds of cheese made in Great Britain. These may be called types, as, with the exception of the Stilton,

there is little difference among them except for size or style. The process of manufacture is similar and the flavors are almost identical. The weights are: Cheddar and Cheshire 65 to 71 pounds.

Cheeses made in Great Britain (Thompson)

<i>Hard pressed</i>	<i>Blue veined</i>	<i>Other cheeses</i>
Cheddar	Stilton	Pont L'Eveque
Cheshire	Wensleydale	Bondon
Lancaster	Gorgonzola	Grevais
Leicester	Dorst blue	
Gloster		
Derby	<i>Soft cheese</i>	
Wiltshire	Camembert	
Cleveland	Cambridge	
Berkshire	Coilommier	
Dunlop	Cream cheese	
Caerphilly		

It is interesting to note the cheeses on the London market in the regular quotations for March 28, 1925, as follows: Stilton blue, Danish Roquefort, Italian Gorgonzola, South American Parmesan, Italian Parmesan, Swiss Emmenthal Gruyere, Swiss petit gruyere, Finnish gruyere, Genuine French Roquefort, Normandy Camembert, Dutch midgets, Colonial Cheddar, Finest Gouda, Parmesan (bottles), Dutch rindless (5 pound blocks), Scotch Dunlops, Canadian, and Camembert.

STILTON—Stilton cheese is without doubt the best English cheese. It originated in Leicestershire at Stilton about 1785, and was first manufactured by a relative of the proprietor of "OLD BELL" inn. Travelers who ate at the inn immediately spread the fame of the cheese throughout the country and it was not many years before Stilton cheese was the aristocrat of the English cheeses and is now known to all English-speaking people.

The real Stilton is not easily obtained, as the product in that locality is limited; because the grand pastures which suit it can not be extended, and the system of manufacture is still kept close.

The cheeses are not considered sufficiently mellow until they are two years old and show spots of blue mold in the interior. The usual weight of the cheese is from 10 to 14 pounds, although some are made smaller.

CHEDDAR CHEESE—This cheese is named for the village of Cheddar, in Somersetshire, England, where it was first made. It is comparatively an old cheese although the Cheddar process is not old. As used at the present time the word Cheddar refers more to the process than to the particular shape of the cheese. The name is, however, used also to designate a certain size 60 to 100 pounds, 14x16 in diameter.

A stirred curd cheese is one in which the curd is not allowed to mat. A washed curd varies from the Cheddar process in having the milled curd subjected to cold water for a period.

COOPERATIVE ASSOCIATIONS—While cooperative associations have not attained in numbers or extent the progress shown in some other countries, still these associations are responsible for much of the development in Great Britain in recent years. Thompson states that:

"In a battle that raged between private enterprise and cooperative for a number of years, an opportunity was given to those interested to distinguish the elements of good in each case, and at the conclusion of this commercial war the summing up was a clear victory for competition. Private enterprises have, however, gone forward with a courage and daring that calls for admiration from even the cooperative enthusiast."

These cooperative associations take several forms. The cooperative creameries (butter factories), cooperative milk-distributing plants, cow-testing associations, breeding associations, and herdbook associations.

Scotland has used the cooperative system for dairy development much more than has either England or Wales.

COW-TESTING ASSOCIATIONS — The first association organized in Scotland was in 1903 and the number has increased continually since that date. The total number of associations in 1922 was 40, and there were 28,000 cows under test. These cows were of various breeds—Ayrshire, British Friesian, Jersey, Short-horn, and Red Poll.

The first association organized in England was in 1914 and the number of associations had increased until in 1923 there were 55 with 104,000 cows under test.

According to the Minister of Agriculture there has been a register of dairy cattle established and certain standards fixed

whereby cattle of dairy breeds meeting the requirements may be registered. The standard is based on the yield of milk per year and is as follows for the breeds: Friesian, 10,000 pounds, Ayrshire, 9,000 pounds, Blue Albion, Lincoln Red Shorthorn, Short-



Some Other Specialties of the Dairy Supply Co., Ltd.

horn, Red Poll and Crossbreeds, each 9,000 pounds, and all others 8,000 pounds. More than 13,000 cows have already reached the standards set.

COOPERATIVE CREAMERIES—The cooperative creamery is scarcely known in England. In 1910 there were only 14 cooperative dairy associations, in 1921, 38, and in 1922, 30. In Scotland it seems that the cooperative system will develop more than in England, as the English farmer is generally able to find an outlet for whole milk and the making of butter is not so remunerative in England as in Scotland.

HERDBOOKS AND BREEDERS' ASSOCIATIONS—There are 15 cattle breeders' societies that issue herdbooks and a few associa-

tions which do not issue them. Pedigree records began with the Shorthorn herdbook in 1820. One of the oldest societies and one which exerted a great deal of influence was the Kalmarnock farmers' club, founded in 1793. The Ayrshire herdbook society was organized in 1877, the Galloway cattle society was founded in 1877, Highland cattle herdbook was founded in 1884, the Hereford herdbook was established in 1845, the Red Poll herdbook



**Chief Offices of United Dairies, Ltd., 34, Palace Court, Bayswater,
London, W. 2.**

Courtesy of Ernst Kelly.

was founded in 1874, the Angus herdbook was founded in 1862. and the Welsh Black cattle herdbook was founded in 1904. The North Wales herdbook was established in 1883.

The purpose of these herdbooks was the establishment of definite standards of purity of breeds and the recording of the best cattle of the land. These advantages were soon recognized by breeders and definite progress may be reckoned from the dates of the herdbooks of each society.

WHOLESALE MILK-DISTRIBUTING ASSOCIATIONS—A number of cooperative milk-distributing associations were established and were successful in maintaining a regularity in the milk supply to the large cities. When these associations had a surplus

of milk it was not forced on the market but was made into butter or cheese or both. These wholesale distributing associations, however, had a severe setback at the close of the World War, that is, in 1919-1920. During the war the production of milk was encouraged and the government guaranteed a price which caused the farmers to steadily increase the deliveries of milk. Any surplus was made into cheese and if there was a loss the government made it good. This in turn caused an increase in the price of feed and cost of production until the winter price was named for 1919-20, when the people (consumers) raised an outcry and encouraged a strike on the farmers for profiteering. The consumption of milk was cut and the surplus was piled up in the depots as cheese. As the cheese subsidy was already rather expensive the government removed the control in the spring of 1920, thus removing the guaranteed price. As this came in the spring after plans for the year had been completed for the farmers under the control system, it naturally worked a hardship on them and the distributors. These events tended to mitigate against the cooperative organizations for a time.

Following this depression the market milk industry about London was seriously affected by the drop in prices and the uncertainty of the market in 1920. The farmers had no part in the selling of milk except through the cooperative organizations. Conditions were made even worse by the farmers, wholesalers, and retailers each of whom tried to get control of the milk distribution. While the wholesalers and retailers were consolidating the farmers were organizing cooperative associations, which latter kept the price of milk steady and on a fairly economic basis during the years 1920 and 1921.

LONDON MILK SUPPLY—London, the largest city in the world, requires a very large amount of milk daily for its household use. The supply is maintained by dairies which are well up-to-date and which furnish milk as pure and fresh as is found in the best cities of the world. The United Dairies, Ltd., is one of the largest distributing firms and has a capital of nearly 25 million dollars, employs 12,000 people, and maintains laboratories and a large corps of milk inspectors while it manufactures its surplus into various kinds of dairy products including cheese, butter, malted milk, and ice cream. It has 15,000 shareholders. The

company has 600 milk shops and more than 100 factories and creameries, including the country plants. It handles 1,000 tons of milk daily, making a million calls to deliver it. This company



New Clarifying, Pasteurizing and Cooling Plant at Harrow Road—dealing with up to 2,400 gallons cream line milk per hour by the low temperature holding methods, approved by the Ministry of Health. (United Dairies, Ltd., London.)

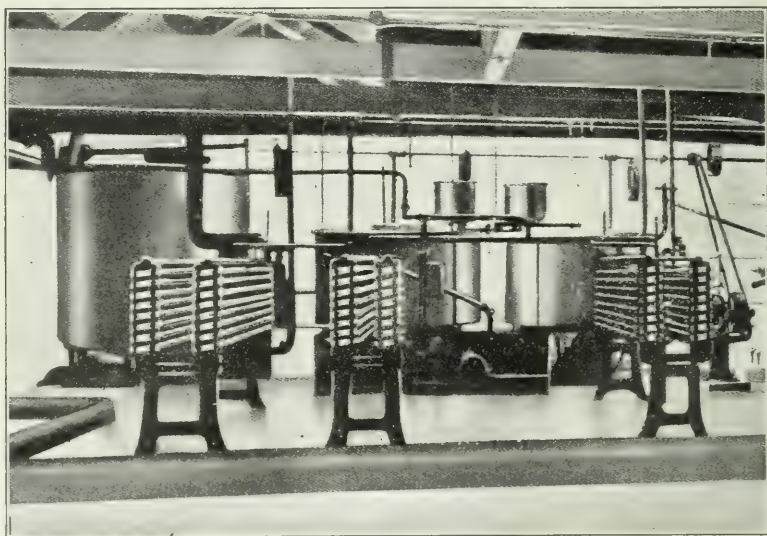
together with the London Wholesale Dairies, Ltd., which is also highly equipped, furnishes most of the milk for Greater London.

CONDENSED MILK—Very little attention has been given to the production of condensed milk, sweetened or unsweetened, in Great Britain. This is due largely to the same conditions which prevent the production of butter; the milk is needed for whole-milk consumption.

During the World War and for several years after the trade in this commodity was very large. Before the war the canned-milk trade was mostly in the hands of the Netherlands and Switzerland and in 1913 the imports into Great Britain amounted to 134,650,000 pounds. The total imports were at their highest point in 1919, when they reached 240,340,000 pounds. During the war and after it for a time the United States took a large part of the trade, as the other countries which usually supplied the

canned milk had a much reduced production and also were unable to export so freely as before the war. Canada, Australia, and New Zealand are now entering the trade in condensed milk with Great Britain, while Switzerland and the Netherlands have again returned to about the normal production of milk and are again assuming their part in that trade.

ICE CREAM—Possibly no branch in the dairy industry is receiving so much attention as is the ice cream branch. Within



One of the United Dairies' low temperature holding pasteurizing plants in which milk is retained for 30 minutes at a temperature of 145 degrees F., as required by the Ministry of Health.

the last few years the manufacture and sale of ice cream has increased many times and it is now sold in all the leading cities. The Italian ice-cream-milk (Spumoni) is being replaced by the American ice cream. In 1922 the Italian vendors numbered about 60,000 and there were upwards of 200 wholesale factories.

It is claimed that the production and consumption of ice cream in Great Britain increased more than 100 per cent during the year 1924.

MARKETS—The United Kingdom has been looked upon for years as the greatest world market for dairy products, including

butter, cheese, condensed milk, sweetened and unsweetened, and its markets have also imported vast quantities of margarine and some filled cheese (margarine cheese). It is difficult to get a definite idea of the aggregate consumption of any of these articles, as the



United Dairies were the first in London to establish a fleet of glass-lined milk plants on motor lorries, for the transport of milk from the country to London. Each will carry 1,200 gallons as a single load.

production figures of the domestic products are not available except for a few years and then only as estimates which do not agree well.

The city of London alone consumes annually 92 million imperial gallons of milk which is mostly shipped into the city by railroads. In 1917 the English board of agriculture issued a statement estimating that 71 per cent of the milk produced was used for household purposes, 12 per cent used for buttermaking, 4 per cent for cheesemaking, and 1 per cent for cream; the remaining 12 per cent was used for home supplies on the farms.

The English market seems to give preference to the British make of dairy products. The best British butter in 1909-10 averaged 28.16 cents, Danish, 25.51 cents, New Zealand, 24.22 cents. Cheese for the same years showed the average for British make as 15.72 cents, and Canadian as 13.24 cents. The average

for butter for the year 1924 was, Danish, 42.5 cents, New Zealand, 39.8 cents, Australian, 38.0 cents.

BUTTER—The United Kingdom as a market has ranked first, having imported more than 100 million pounds of butter a year ever since 1870, and the imports for the year 1925 reached 656 million pounds. This great quantity of butter represents more than 60 per cent of all the butter on international trade for the year. During the World War there were no facilities for the importation of butter even from Denmark in the usual quantities; hence, the imports fell to about 175 million pounds in 1918. (In 1914 the imports were 460 million pounds.) After the year 1920 the imports again increased until in 1925 they were above the pre-war level. During the war the government placed many products under government control and had fixed prices for whole-



"The Bottle-Pram"—which is now a familiar sight on London streets.

sale and retail. The colonial dairy products and some others were contracted for by the year. This gave the colonies a very good price during that period and encouraged greater production. At the end of the war New Zealand and Australia were exporting to Great Britain much larger quantities of butter and cheese than before the war. The imports from Denmark, the Scandinavian countries,

together with Russia, were greatly decreased, and the contest for recovery of the markets of Great Britain became more and more marked.

The British market accepts all grades of butter. Much of the higher quality butter is used for blending with medium and lower grades; however, there is a demand for the best butter "as it comes from the creamery." The imports of butter are still increasing year by year.

CHEESE—The imports of cheese into the United Kingdom have exceeded 100 million pounds since 1870. The highest point of imports was for the year 1925 when the amount was 347 million pounds. The export was small. Unlike butter the cheese



1.—The Manufacture of Dried Milk at the Company's Buckingham Factory.

2.—Milk Powder Making and Packing at Buckingham.



United Dairies, Ltd., London.)

imports increased during the war and by the end of the war were 10 per cent higher than previously. This was due to the difficulty of getting meat and to the fact that cheese-exporting nations were situated more out of the immediate war zone.

The cheese imports are largely Cheddar from Canada, New Zealand, Australia, and the United States, but large quantities of

Netherlands cheese, Gouda and Edam, Cheddar and Swiss cheese, French Roquefort and Camembert, are also imported.

It is an old English saying that "A table is not fit to sit down to unless it has cheese on it."

MILK POWDER—Milk powder and preserved milks are also imported in large quantities; the milk-powder imports, including skim-milk powders, sweetened and unsweetened, amount to from 8 to 10 million pounds a year and appear to be increasing.

CONSUMPTION OF DAIRY PRODUCTS—As indicated by the imports the people of the British Isles are consumers of large quantities of dairy products. When the home production is added



1.—Devonshire Clotted Cream in Process of Preparation at One of the Company's Devonshire Creameries.



2.—Packing Dairy Cream in Jugs and Jars for Retail Sale.

(United Dairies, Ltd., London.)

to the imports the consumption is really very large. The butter consumption in the period from 1909 to 1913 is estimated by the British Food Journal as averaging 748 million pounds a year, and cheese 354 million pounds, margarine 264 million pounds, while in 1918 the margarine was 569 million pounds.

The size of the British market can hardly be realized but if it is stated that the market is open for 10 hours a day it will have

to receive one ton of butter a minute, two-thirds of a ton of cheese a minute, and one-half a ton of condensed milk a minute to supply the demand. Most of these imports are received through the London market.

Schools Having Dairy Courses.

Location	
Aylsbury	British Dairy Institute
Basing	Hampshire Farm School, Dairying for Boys and Girls
Chelmsford	Essex County Dairy School
Chilcombe	Dorsetshire Cheese School
Cirencester	Royal Agricultural College
Cumberland and Westmorland	Farm School
Garford	Dairy School
Gloucester	Dairy School
Griff House, Warwickshire	Dairy School for Girls and Women
Helmsley	Dairy School
Hutton	Farm and School
Ipswich	Eastern County Dairy Institute
Kingston	Midland Agricultural and Dairy Institute
Leeds	University of Leeds, Dairy Course
Llewerri Hall Dairy School	Short Course and Traveling School
Halloughton Grange	Farm School
Preston	Harris Institute
Shropshire	For Girls
Skenfrith	Cheese School
Springhall	Young Ladies
Stoke Prior	Worcestershire, for Women
Wilts	Wiltshire School
Woburn	Agricultural Institute
Worleston	Cheshire Dairy School

WALES

Aberystwyth	University College of Wales
Cardiff	University College of South Wales
Carnarvon and Anglesey	Dairy School
Welshpool	Sylfeen Dairy School

SCOTLAND

Dunfermline	Dairying
East of Scotland Agricultural College	
West of Scotland Agricultural College	
Kilmarnock	

In Great Britain there are 21 itinerant schools maintained by the county councils and these all teach dairying.

CHRONOLOGICAL EVENTS

YEAR

- 1627 Hereford breed of cattle noted (Speed).
- 1700 The Gaelic people had Highland cattle.
- 17-18 centuries—Dutch cattle imported.
- 1750 Highland cattle in Strathmore.
- 1763 Imports of cattle forbidden in Jersey Island.
- 1788 Herefords first bred on islands (Marshall).
- 1793 Kilmarnock farmers' club founded, and later developed the Ayrshire breed.
- 1800 Bates founded line of Shorthorn breed.
- 1820 Shorthorn herdbook founded.
- 1840 Pleuropneumonia in cattle came from Ireland to England.
- 1845 Hereford herdbook founded.
- 1846-8 Great Irish famine (potatoes failed).
- 1846 Red Poll breed—two breeds amalgamated.
- 1853 Exports of Jersey cattle to the United States, very heavy exports.
- 1862 Angus herdbook founded.
- 1865 Severe cattle plague from Russia appeared.
- 1872 British agriculture at its height.
- 1874 Red Poll herdbook founded.
- 1874-96 Great agricultural depression.
- 1877 Ayrshire herdbook founded.
- 1877 Galloway cattle society founded.
- 1882 Large exports of Jersey cattle to the United States.
- 1883 North Welsh herdbook founded.
- 1884 Highland cattle society founded.
- 1885 Milk trains began running into London twice daily.
- 1889 Sir Horace Plunkett led in co-operative movement in Ireland.
- 1898 Pleuropneumonia stamped out.
- 1903 First cow-testing society organized in Scotland.
- 1904 Welsh Black cattle society founded with one herdbook.
- 1912 Famine price—butter consumption fell to 14.9 pounds per person.
- 1914 First cow-testing association founded in England
- 1914 World War.

NUMBER OF COWS AND TOTAL CATTLE
(British Statistical Abstract and Board of
Agriculture and Fisheries)

Year (June)	Cows	Total Cattle	Year	Cows	Total Cattle
1875	3,783,607	10,128,112	1916	4,499,321	12,451,540
1880	3,639,755	9,833,563	1917	4,514,803	12,382,236
1890	3,956,321	10,789,421	1918	4,603,841	12,311,149
1900	4,096,682	11,455,009	1919	4,587,805	12,491,427
1910	4,342,186	11,765,453	1920	4,381,794	11,770,274
1915	4,494,740	12,171,452	1921	4,575,421	11,893,000
.....	.....	.....	1922	4,607,488	12,062,000
.....	.....	.....	1923	4,657,052	11,999,000 (1)
.....	.....	.....	1924	4,666,796	12,007,000 (1)

(1) Not including the Channel Isles for the years 1923 and 1924.

MILK PRODUCTION AND YIELD PER COW
(Minister of Agriculture and Fisheries)

Year	Annual Yield Per Cow	Annual Produc- tion Less Milk for Calves	Year	Annual Yield Per Cow	Annual Produc- tion Less Milk Fed to Calves
	Imperial Gallons	Million Gallons		Imperial Gallons	Million Gallons
1909-13	560	1,231	1919	470	1,085
1914	575	1,253	1921	550	1,223
1915	550	1,241	1922	575	1,318
1916	525	1,164	1923	...	1,350
1917	495	1,086	1924	...	.....
1918	436	955	.....	...	.....

AVERAGE ANNUAL CONSUMPTION OF DAIRY PRODUCTS
(Estimates of British Food Journal—July-October, 1919)
(Thousand Pounds—000 Omitted)

Product	Total Consumption	Home Production	Importation
	Pounds	Pounds	Pounds
Butter.....	748,160	282,056	466,104
Cheese.....	353,920	89,542	264,388
Margarine.....	264,320	134,275	130,045
Margarine (1918).....	568,960	535,391	33,569

IMPORTS AND EXPORTS OF BUTTER
(Trade and Navigation)
(Thousand pounds—000 omitted)

Year	General Imports	Domestic Exports	Year	General Imports	Domestic Exports
	Pounds	Pounds		Pounds	Pounds
1850	35,824	6,792	1917	202,330	264
1860	94,093	14,039	1918	176,810	197
1870	129,832	6,443	1919	174,743	262
1880 (1)	260,546	3,518	1920	190,647	363
1890	227,104	2,745	1921	394,685	1,105
1900	378,364	1,177	1922	478,079	1,673
1910	484,160	1,035	1923	570,697	2,092
1915	431,632	1,178	1924	592,171	2,239
1916	243,646	980	1925	655,704	1,445

(1) Imports in 1880 included margarine.

IMPORTS AND EXPORTS OF CHEESE
(Trade and Navigation)
(Thousand Pounds—000 Omitted)

Year	General Imports	Domestic Exports	Year	General Imports	Domestic Exports
	Pounds	Pounds		Pounds	Pounds
1850	33,003	968	1917	329,959	212
1860	65,328	3,214	1918	263,996	70
1870	116,623	2,822	1919	237,244	111
1880	198,912	1,333	1920	308,029	454
1890	240,136	1,368	1921	315,556	479
1900	303,058	1,047	1922	297,847	581
1910	275,110	911	1923	317,917	946
1915	305,372	825	1924	323,401	843
1916	291,662	986	1925 (1)	347,441	1,950

(1) Figures for 1925 are preliminary.

IMPORTS AND EXPORTS OF CONDENSED MILK
(Trade and Navigation)
(Thousand Pounds—000 Omitted)

Year	General Imports	Domestic Exports	Year	General Imports	Domestic Exports
	Pounds	Pounds		Pounds	Pounds
1888	26,754	.....	1919	356,079	1,437
1890	34,371	6,887	1920	221,141	6,670
1900	92,109	23,458	1921	243,849	4,065
1910	113,094	49,194	1922	211,664	15,589
1915	176,682	37,628	1923	252,857	13,825
1916	191,273	35,207	1924	249,908	11,023
1917	183,275	14,271	1925 (1)	257,061	11,096
1918	287,581	1,383	.....	.....	.....

(1) Preliminary. (All figures included whole milk and skim milk condensed).
Note—Prior to 1888 condensed milk was included in "Other dairy products".

IRELAND

(Irish Free State and North Ireland)

NATURAL CONDITIONS—The total area of Ireland is 32,360 square miles, (20,710,400 acres) of which 23,801 square miles are in the Irish Free State and 8,559 square miles are in North Ireland. Up to the time of the World War only 12 per cent was under cultivation, but the cultivated area has been increased since the war. The smallness of the land under cultivation limits the production of grain and not enough is produced for winter feeding which in turn causes a very small production of butter in the winter months.

PASTURE LANDS—The present condition of a large part of the pasture lands, arising out of unsuitable or inadequate seedling, and subsequent inattention, is a source of considerable loss to the country. How great this loss is will be realized when it is remembered that there are in the country, North Ireland and South Ireland, in addition to about 8 million acres of permanent pasture, about 2½ million acres of mountain grazing, and close to 1¾ million acres of barren mountain land, bog, and marsh. The Department of Agriculture says, "A very large proportion of such lands could be greatly improved without unreasonable outlay of capital or labor."

Ireland, with a mild, open winter and abundant grass, is a country specially suited to stock raising and dairy farming. The full development of these important branches of farming is dependent on an increased supply of those bulky crops (forage) which no importation of foodstuffs can supply. At present the main output of fat stock and dairy products is confined to the summer months. A more even production throughout the year would be no less profitable to the producer because it would increase the supply of home-grown feed and would thus reduce the overhead cost on the farms.

The damp climate and variable rainfall make it unlikely that under a system of free imports grain crops can ever compete successfully with foreign imports.

EARLY HISTORY—The people of Ireland have always been an agricultural people and have also depended much on the grass land and cattle. In reality the dairy history of Ireland is divided into two parts, i. e., before Sir Horace Plunkett and after him, that is, before cooperation and after it began.

In the early days the Irish lands were in the possession of clansmen but during the British conquest the lands gradually passed into the hands of large landowners (1800) who turned them into large estates, generally for grazing purposes. Not much progress, if any, in dairying was made during that period but there was, indeed, a large production of farm butter, as indicated by the receipts on the market at Cork, amounting to 105,309 packages in a year. The exports of farm butter reached back nearly to the year 1700 A. D.

The early history of cattle, of dairying, and of the development of the breeds in this country were nearly the same as in Great Britain of which Ireland was a part up to the year 1920. Possibly the invasions of England and Wales by the Danes, Saxons, and Normans had little effect on Ireland and its native breeds of cattle. The original cattle of Britain and Ireland, probably black in color, are thought to be best represented by the Kerry cattle and the Longhorns of Britain and Ireland; however, the Welsh cattle are somewhat similar to the Kerry breed and may be a part of the original cattle. The Longhorns have made some changes in their characteristics and are, therefore, quite different from the original Longhorns.

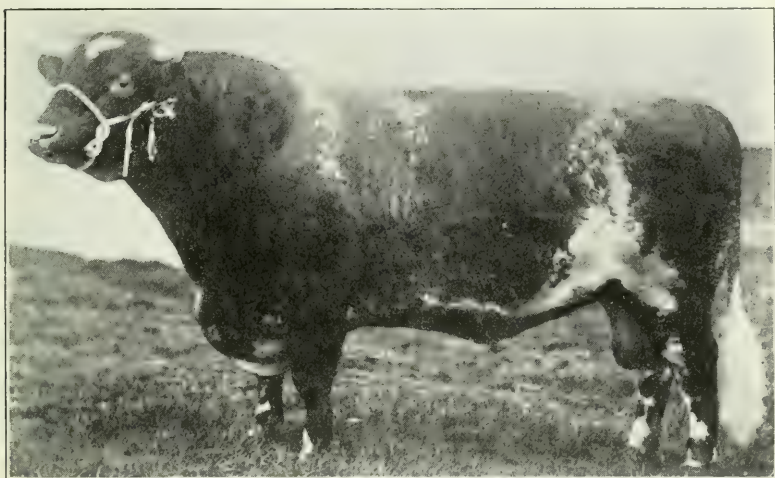
CATTLE—The number of dairy cows has varied but little in the last 80 years and is now, about $1\frac{1}{2}$ million, being about 30 per cent of all cattle in the country.

The policy of the government seems to be to develop the dual-purpose breeds, for beef and milk. Department (Free State) leaflet 62 gives the ideals as held up to the breeders, as follows:

"Success or failure in dairying depends upon the class of cows kept for breeding. To maintain our trade in dairy products and our great industry in store and fat cattle it is essential to have cows that will return a reasonable profit as dairy animals and at the same time produce calves that can be converted into beef with satisfactory results."

MILKING SHORTHORNS—Most of the cattle of the dairy breeds of Ireland are Shorthorns, or grades of that breed. It is

asserted that 85 per cent of the purebred cattle of the country are Shorthorns. In many instances the breed is crossed with the Kerries and the grades of such crosses yield much more milk than the Kerry dams, the increase being estimated at 25 per cent.



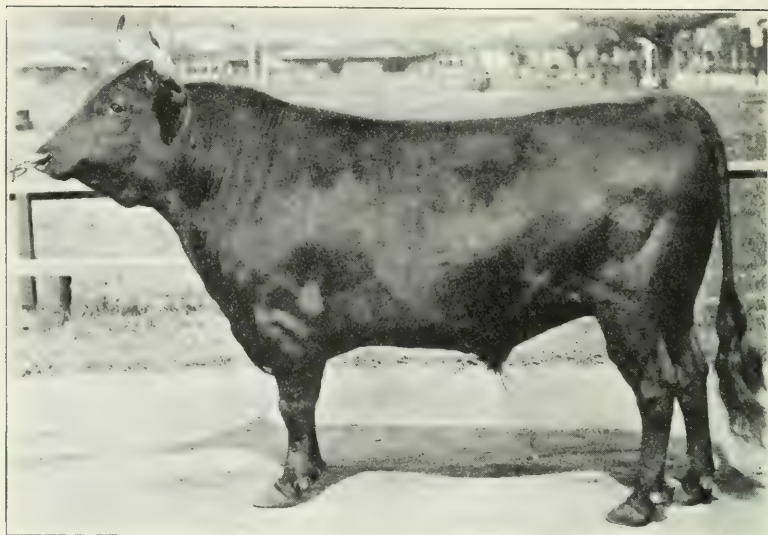
Shorthorn Bull—Champion of many fairs and shows.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

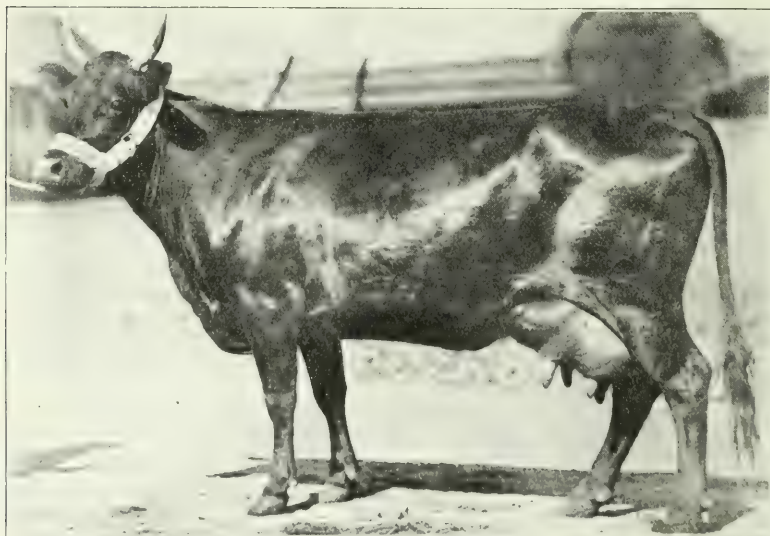
The improved cattle were originated in England in the 19th century but by the year 1850 Irish farmers are said to have possessed more purebred Shorthorns than were owned in England; hence, the breed is nearly indigenous to Ireland.

KERRY CATTLE—It is difficult if not impossible to trace with any degree of accuracy the origin of the Kerry cattle, but there are data enough to establish the fact that Kerry cattle, as a distinct breed or type, existed in Ireland from a very remote time and that the cows have always been noted for their large yield of milk. It is generally believed that all the native cattle were black, like the Welsh cattle.

The Kerry cows weigh from 800 to 900 pounds and yield about 350 gallons of milk a year. The Kerry is sometimes called "the poor man's cow" on account of its size and as many of the peasants can not afford to keep the larger cattle. The cows are neat, active, and are excellent rustlers, but when removed from poorer soil to the better grazing lands, are said to increase in size.



Kerry Bull.



Kerry Cow.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

Some of the Kerry cows have truly wonderful records. In 1921 Duv Time, weighing only about 784 pounds, milked 46.6 pounds of milk in 24 hours, the butterfat content being 5.14 per cent. Her yield of butter would thus work out at $2\frac{3}{4}$ pounds for the day. (Irish Homestead.)

Kerry cow, Gort Curley 4th, completed a phenomenal milk yield of 11,388 pounds in the calendar year 1921; or in other words, this little cow of 868 pounds gave more than 5 tons of milk, or 13 times her own weight in 52 weeks. (Dairy World.)

The Kerry cattle are bred pure as the commercial cattle on all the farms in the mountainous regions of Kerry county, and have been exported to the United States, Argentina, South Africa, and Australia.

DEXTER BREED—About 1840 Mr. Dexter introduced this breed, which is really a cross of the Kerry breed but is much larger. Trouble which later developed in breeding the type pure, caused the failure of the breed and it is now practically of little interest in Ireland.

MAOILIN BREED—The Irish Maoilin breed of hornless cattle is very ancient in its origin. They have dark-brown, yellowish coats, generally whole colored, but sometimes spotted-white on the head and shoulders. At present there are only 8 or 9 herds.

According to some writers the native home of this breed stretched east of the Shannon to Tipperary but now it is found chiefly in the western part of the island from Donegal to Cork. The distinctness of this breed is shown from the fact that, however much crossed, it is dominant and recognizable even to the 10th generation. It is due to this fact that the breed is not today extinct. A society has been formed for reestablishing the breed.

Maoilin cows are excellent milkers; they give from 8 to 10 gallons a day in summer and from 4 to 5 gallons in winter of rich milk. They are not liable to any disease, it is said. According to some authors the hornless character of some of the present Scotch and English breeds may be due to the cattle introduced into East Anglia and Scotland by early Irish colonists.

Development—BEFORE THE COOPERATIVE MOVEMENT—There is little recorded information relative to the possession of cattle, and the development of dairying prior to 1887. It is

known, however, that for more than 100 years there had been large surpluses of farm butter produced by pioneer methods and the most crude utensils. This butter found its way to the principal markets of the country, Cork and Dublin, and thence to England and all its great centers of population.

The cattle were of the Kerry, Longhorns, and Shorthorns breeds with crosses and grades of the Shorthorn and Kerry cows. Some of these cattle were quite well developed but hardly so well as in England. The feeding and care of the stock were generally bad. Few of the other breeds found their way to the island. The average yield of Irish cows (North and South) in 1879 is given as 430 imperial gallons.

At the end of this period, about 1889, there had been much interest in cattle raising as the Herdbook was established in 1887. However, the Royal Dublin Society's Spring Show in 1844 recognized the Kerry breed and provided a class for them. This is an early date for the breed to be classed as such.

At the Paris Exposition in 1878 Ireland took the only gold medal for preserved canned butter. The encouragement to make butter is shown by the prices for a number of these early years:

	Average cents per pound
1840-51	18.2
1852-61	22.6
1862-71	26.0
1872-81	17.9

SINCE THE COOPERATIVE MOVEMENT BEGAN—The co-operative movement had its origin when Sir Horace Plunkett determined to solve some of the depressing problems affecting the dairy industry, and thereby help in the betterment of his countrymen. The "factory system" had just begun to take hold in the country and the advantages of this system were being studied. This "factory system" was in reality farm buttermaking, the butter being packed in firkins (112 pounds) and sold to the merchants at the ports of export. Some of the makers had a high degree of skill and the reputation of Cork butter was known throughout Europe. With the introduction of the factory system and still more with the creamery system, to which the merchants did not take kindly, the market at Cork commenced to decline and finally

ceased to exist in 1923. The creamery system is identical with the "factory system" of other countries.

For some years prior to the establishment of the creamery system, what is now known as the "factory system" came into vogue. Under this factory system, butter continued to be made on the farms, but was sold in loose "lumps" at local markets to buyers who attended these markets from the butter factories of the cities. At the factories the "lumps" were sorted and blended to produce a more uniform quality, and excess moisture was removed. Though this system was much inferior to the creamery system, inasmuch as the factories had no control over the important stages of manufacture, still the factory system had enabled the factories in the cities to turn out a butter, packed in neat packages with the proper percentage of salt and moisture and to meet the taste of the British consumer.

This system, though it continues to this day, in the poorer districts, where supplies of milk are not sufficient to support a creamery, has been gradually superseded by the creamery system under which a butter of much better quality is produced.

As this factory system offered a good opportunity for cooperation the promoters of cooperation recognized it. The country was much in need of it, as their lands were poorly cultivated, the farmers as a rule were ignorant, and all their products were poorly marketed. A "higgler" would go from house to house buying a few pounds of butter at any price he could make and mix all together regardless of quality, reducing the value of all the butter. Cattle were poorly fed and little or no dairying was done in the winter; therefore, as there was little butter put on the market in winter it necessitated, as one writer says, "the buying of their way back into the market each spring."

Sir Horace Plunkett advocated two points as fundamental to all successful cooperative societies—that the farmers should receive a more equitable share of the profits of dairy products and also that these profits must be reflected in improved living standards.

The first cooperative creamery was begun in 1890 after months of effort. Some meetings were attended by the village schoolmaster and himself only, but Mr. Plunkett was not discouraged and there were 19 factories organized by 1891 and 64 by 1894, while in 1925 there were 750 in North Ireland and 1,600 in Free State.

The paid-up membership was 135,369 with 250,000 contributing cows. The most progressive creameries are equipped as well as those of any country and pasteurization is fast becoming universal.

At the beginning of cooperation the Irish farmers with all the advantages of favorable climate, fertile land, and close proximity to the great English markets, were actually being driven off the butter market by the Danes and the French. The compelling reason for the organization of cooperative factories was this competition. It was necessary to substitute for the prevailing Irish system of buttermaking on the farm under haphazard conditions



Ulster Dairy School, Cookstown.

Courtesy of Dennis Hegerty, Dublin.

and with poor equipment, a new method involving the erection of thoroughly efficient creamery buildings with modern machinery. From this beginning the present cooperative system developed.

The creamery system in Ireland is worked on identical lines with the Danish. The gathered-cream system is practically unknown. Usually the creamery takes the milk produced within a radius of three miles. The farmers cart their milk to the creamery daily where it is pasteurized, separated, the cream converted into butter, and the skim milk and buttermilk are returned to the farms

for pigs and calves. In many cases the milk is separated in auxiliary factories (skim stations) and taken to the central creamery where it is made into butter, but these centrals may have an area of their own which delivers whole milk. A central creamery is one which manufactures butter while an auxiliary creamery is what is usually called a skimming station. This auxiliary system is found to be economical, as an auxiliary factory requires the labor of two men only while the central creamery may employ highly trained men to manufacture the butter. The central plants are equipped with modern machinery and include a refrigerating plant and in addition may sell or export direct. Women trained in the government dairy schools are used for buttermakers. In a few cases men are employed after some "practical" training. These creameries now produce an excellent quality of butter.

The managers of central creameries undergo a two-year course of training under the Department of Agriculture, one year of which is spent at the College of Science, or University, the remainder of the time is used in practical work at an approved creamery.

Among the voluntary organizations which have assisted in the advancement of the industry may be mentioned the Irish Creamery Managers' Association which has been in existence ever since 1900. The secretary, Mr. Hegerty, a graduate of Glasnevin Agricultural College, and a practical creameryman for years, has been active in the advancement of the industry and was secretary for Irish butter export during the World War. This association was largely responsible for the recent legal standards established for dairy products. This association holds examinations for managers of creameries and publishes a journal on the market news.

THE DAIRY PRODUCTION ACT—The Free State parliament passed an act for the improvement of the dairy industry, under which the creameries are being subjected to rigid governmental inspection, the ultimate object being the standardization of the product, and the issue of a national brand to all creameries which comply with the conditions.

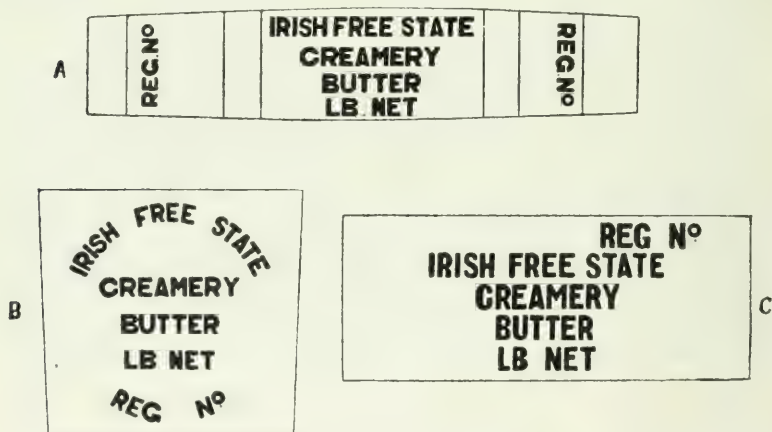
About two-thirds of the creameries are cooperative, that is owned by farmers on the limited-liability plan. The remainder are owned by proprietors. Most of the latter are owned by the Condensed Milk Co. of Ireland (1924) Ltd. (formerly Cleaves), but a large number are owned by the Newmarket Dairy Co., Ltd.

The cooperative system was introduced about 1890 and commenced by the establishment of creameries registered under the Companies Act by the larger farmers in certain districts in the South. Sir Horace Plunkett, aided by the English Cooperative Union, then took the matter up, and later in 1894 the Irish Agricultural Organization Society was started and the movement spread very rapidly.

- ORGANIZATIONS The Irish Dairy Association, issues weekly butter quotations.
 Creamery Managers' Association.
 The Irish Co-operative Agency Society of Limerick, a federation for the sale of butter, established in 1892.
 The Irish Shorthorn Breeders' Society established to encourage the cow-recording associations.

Third Schedule.

I. Design to indicate the manner in which the prescribed marks should be placed on packages packed on premises registered in the register of creameries or comprised in a subsisting license granted under Section 42 of the Act.



A—Side of standard cask or keg.

B—Side of standard box.

C—Side of package containing butter packed in bricks or rolls.

COW-TESTING ASSOCIATIONS (Cow-recording societies) — These associations were first organized in 1909 but the interest was lax at first and the progress was slow. At first it was looked upon as a fad. However, just prior to the organization of the cow-testing associations the government decided to encourage the improvement of dairy cattle in Ireland. The Department of Agri-

culture directly supervised the recording of the milk produced by purebred cows and those which reached certain standards were entered in the register of dairy cattle.

In 1910 this scheme was transferred to the cow-testing associations for the promotion of these associations. Since 1912 the following standards have been in force as the requirement for register:

Shorthorn and British Friesian . . .	6,000 pounds milk, fat not less than 3 per cent
Kerry and Jersey	4,500 pounds of milk, fat not less than 3 per cent

The department decided that after the year 1912 applications for inspection of nonpedigree cows with a view to registration would not be accepted unless through an accredited cow-testing association.

The Royal Dublin Society carried out a series of inspections for qualification of foundation stock up to the year 1900, when the Herdbook was closed to bulls other than pedigreed animals. For the same reason the females were refused inspection after 1904. This pertained only to the Kerry breed, however.

North Ireland had in 1924, 11 cow-testing associations with 2,346 cows yielding an average of 621 Imperial gallons of milk with a fat content of 234 pounds.

Irish Free State in 1923 had 154 cow-testing associations with 36,000 cows, and in 1924 there were 173 associations and 42,300 cows on test.

Cow-testing began its real development in 1920 when the government rendered assistance by agreeing to give 3 shillings per cow when the members gave 2 shillings. If the members are required to give 4 shillings the state was willing to give 5 shillings per cow tested.

The dairymen of Ireland believe that their own cows are as good as the cows of any other country at the time cow-testing began and that, therefore, they can win without importing special breeds.

No cattle are permitted to enter Ireland except from Great Britain and then only under license from the Department of Agriculture.

According to Whyte, 1922, new plants built in Ireland are a great improvement on the old ones:

"Considerable progress was made recently in the installation of new chilling plants in Irish creameries, particularly at centers where the machinery was destroyed during the conflict of last year (1921). It will be recalled that upwards of 40 central creameries were put out of action previous to the truce; and, by an unfortunate stroke, the refrigeration machinery and cooling appliances were the parts of the organization to suffer most. As a compensation, to some extent at least, for the loss and great inconvenience caused to the industry at that time, the destroyed refrigeration plants, many of which were undoubtedly obsolete, are being replaced by the most modern and efficient types. Every system of refrigeration is represented in Irish creameries and the controversy still continues as to which is the most suitable for these conditions. The one satisfactory thing is that nearly all the modern makes are not only practically fool-proof, but the risk of a breakdown, which has been a nightmare to Irish creamery managers in the past, is now almost removed so far as the new plants are concerned."

EXTENT OF THE INDUSTRY—The number of milk cows in Ireland (North and South) is scarcely greater than it was in 1850 but there has been quite an increase in the yield of milk per cow, due to breeding, feeding, and selection. This yield of milk decreased during the World War and for a few years thereafter it did not regain the loss, but in 1922 the yield was again practically up to pre-war records. The milk production in 1907 was officially estimated as 5,830,000,000 pounds. This dropped to 5,640,000,000 in 1918, but in 1922 it had reached 7,134,000,000 pounds.

TRADE—The exports of butter from Ireland have been large for years; in fact, since about 1700 these exports have had an important place in the world's trade. The principal market and nearly the only one is England. These exports of butter were made mostly in the summer months as there has always been very little dairying during the winter. Sometimes there is an importation of butter during the winter following a heavy exportation during the summer. The present exports of butter are from about 40 million pounds to 95 million a year, but the exports for 1924 were only 51,187,000 pounds and the imports were 8,789,000 pounds.

The imports of cheese generally exceed the exports; however, in 1918 the exports were 15 million pounds against 5 million imports, and in 1919 the exports were 32 million pounds against 4 million imports.

The exports of condensed milk were rather large from 1904 to

1922, ranging from 18 million to 35 million pounds. The imports averaged from 2 to 5 million pounds.

DAIRY PRODUCE ACT, 1924 — Provides: that all butter exported from the Irish Free State shall be exported only from registered premises, registered manufacturers, or register of nonmanufacturing exporters.

Packed in standard packages, i. e., 112 pounds, 56 pounds, 28 pounds, and 14 pounds.

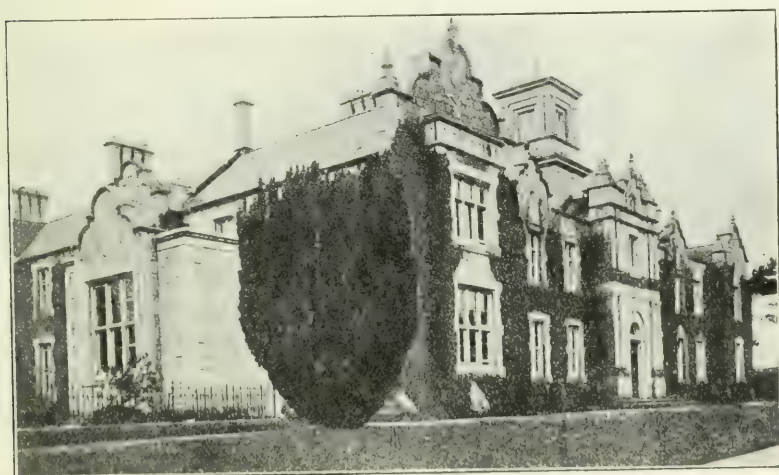
Weight, identification mark, and the words "IRISH FREE STATE CREAMERY BUTTER" placed on each package.

Shall not contain more than 16 per cent moisture.

Has a definite standard for purity of salt.

DAIRY SCHOOLS — Ireland has three well established dairy schools which have proved their quality by their dairy graduates.

Location	Kind
Glasnevin	School for managers
Cork	Munster institute, for women only
Cookstown	Ulster dairy school



Munster Institute, Cork.

Courtesy of Dennis Hegerty, Dublin.

In addition there are itinerant teachers and instructors of supervisors of cow-testing associations.

CHRONOLOGICAL EVENTS

YEAR

- 1700 Farm butter exported.
- 1730 Four-course crop rotation introduced—corn and manured crops.
- 1769 Butter market at Cork (105,309 packages a year).
- 1830 Agriculture backward—farms small.
- 1846-48 Great famine—potato crop failed—Turning point of agriculture.
- 1878 Ireland took gold medal at Paris Exposition for preserved canned butter.
- 1887 Register for Kerry and Dexter cattle started in Dublin, (now Royal Dublin Society).
- 1889 Sir Horace Plunkett began work for cooperative organizations.
- 1890 First cooperative creamery organized.
- 1890 First volume of herdbook issued.
- 1891 Seventeen cooperative creameries had been formed.
- 1892-3 Irish Cooperative Agency Society, Limited, organized to help creameries market butter.
- 1903 Seventy-one per cent of farmers working farms less than 30 acres.
- 1906 State began overseeing cow-testing records (not a society yet).
- 1909 First cow-testing association organized.
- 1913 Less than 12 per cent of the land cultivated.
- 1917 The Kerry and Dexter cattle society founded in Killarney, later changed to Kerry Cattle Society.
- 1919 1,028 cooperative societies in Ireland, of which 340 were creameries.
- 1920 North and South Ireland set up independent governments.
- 1921 752 cooperative societies.
- 1922 North Ireland had 78 cooperative creameries.
- 1922 North Ireland and South Ireland had 339 cooperative dairy societies.
- 1923 Cork butter market ceased to exist.
- 1924 Irish butter control law passed creating standards and trade-mark.

NUMBER OF DAIRY COWS AND TOTAL CATTLE
(British Statistical Abstract, Agricultural Statistics)

Year	Dairy Cows	Total Cattle		
1851	.....	2,967,481		
1861	1,545,168	3,471,688		
1870	1,529,024	3,796,380		
1880	1,398,047	3,921,517		
1890	1,400,527	4,240,316		
1900	1,458,074	4,608,550		
1910	1,470,972	4,688,888		
1915	1,593,027	5,051,645		
1920	1,470,668	5,019,837		
1921	1,527,292	5,197,121		
<hr/>				
Irish Free State		North Ireland		
	Dairy Cows	Total Cattle	Dairy Cows	Total Cattle
1922	1,257,811	4,326,294	276,580	830,331
1923	1,230,665	4,215,253	265,113	774,109
1924	1,215,415	4,194,189	256,739	735,622

IMPORTS AND EXPORTS OF BUTTER, CHEESE AND CONDENSED MILK
(Reports of Trade in Imports and Exports in Irish Ports)
(Thousand Pounds—000 Omitted)

Year	BUTTER		CHEESE		CONDENSED MILK	
	Imports	Exports	Imports	Exports	Imports	Exports
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
1904	.....	91,368	4,783	128	.....	28,307
1910	.....	78,278	4,879	313	.....	32,743
1915	6,725	93,866	5,766	1,760	3,451	31,163
1920	181	62,185	4,305	16,264	7,291	20,860
1921	1,882	68,609	6,919	3,364	4,917	18,677
1922	11,012	71,035	6,341	1,062	5,277	5,555
1924 (1)	8,789	51,187	2,590	542	.....	.....

(1) Figures for 1924 are for Irish Free State only.



DENMARK

"In no other country does everything give way to dairying as is done in Denmark, and in no other country in the world are the farmers more prosperous and self-respecting."—Thompson.

NATURAL CONDITIONS — Denmark is composed of the peninsula of Jutland and a group of islands and has an area of 16,608 square miles, practically $9\frac{1}{2}$ million acres, of which $7\frac{1}{4}$ million acres are under cultivation. This country lies north of $54\frac{1}{2}^{\circ}$ north latitude. The climate is comparatively mild in winter, as the country is between the Baltic Sea and the North Sea. The summers are temperate and there are no great changes of temperature. The rainfall is about 25 inches a year but is well distributed for crop growing and there is seldom a crop failure on account of drought.

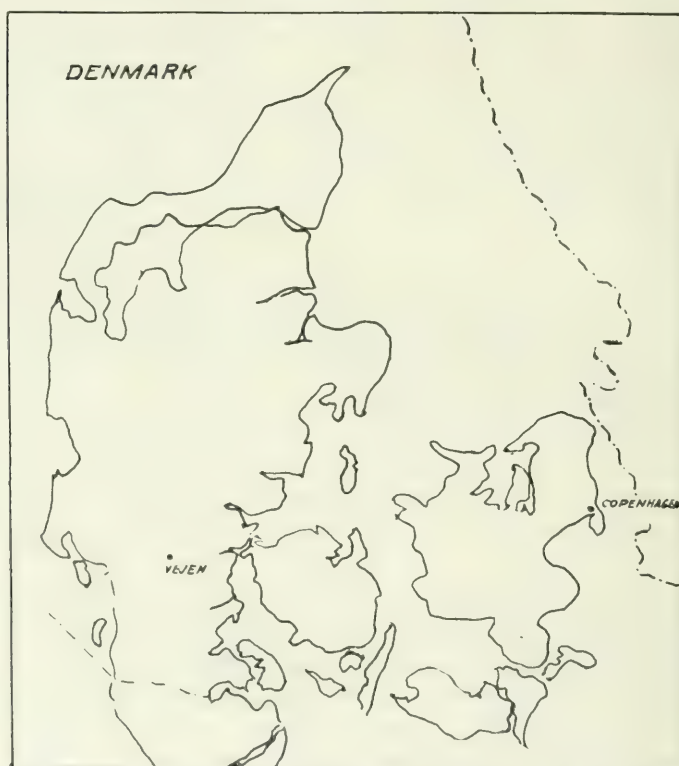
The soil varies greatly in quality but in general is not so rich as in other countries but the productivity has been increased since dairying and scientific farming have been practiced and since commercial fertilizers have been used.

The land in all parts of the country lies low, there are no available mineral resources, and only 8 per cent of the land in forests, thus the other industries are handicapped for lack of fuel, lumber, and water power, and dairying and agriculture are the great resources of Denmark.

Agriculture and livestock raising has been one of the main industries since the earliest times. Formerly they were the main dependence, now they are associated with dairying. Land ownership and tenures in early ages had a depressing effect on agriculture. In Denmark, as in all the other European countries, the large landholders dominated agriculture from the time of the Middle Ages to the close of the 18th century. The peasants of Denmark were under feudal bondage until 1733 and it was not until 1788 that they were not legally liable to oppression by the large-estate owners. Dairying could progress but little under such governmental conditions. Another obstacle was the strip system of land

working, which was common. The peasants lived in villages and worked the land in common. This system was abolished in the latter part of the 18th century, the land parceled out into units of farm-sized plots, and the peasants moved out of the villages to live on their own land. This distribution of the land was done very completely and, therefore, it became possible for dairying to actually exist as an industry.

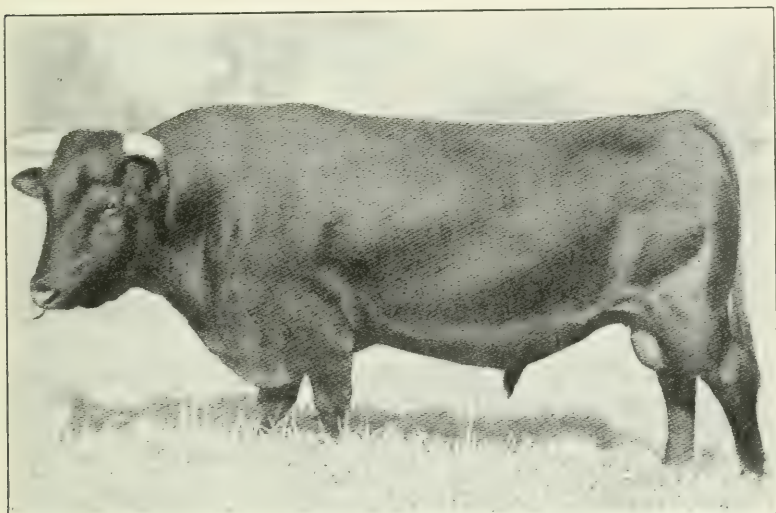
Grain production and cattle raising was the first and chief aim of the peasants until the middle of the 19th century. The grain was chiefly exported to the large cities of Germany and other



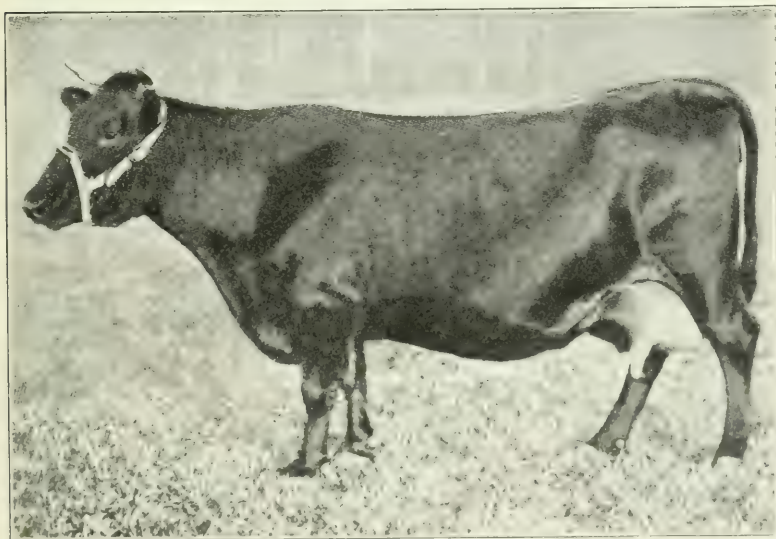
European countries. The marketing of meat or meat cattle in Germany and the Netherlands was practiced also during the same period.

CATTLE—Denmark has but two distinct breeds of native cattle; however, there are a small number of nondescript animals,

including grades and scrubs. The "Red Danish" is the principal dairy breed and is chiefly located in the islands. The Jutland Black and White breed is in the peninsula. These breeds have



Danish Red Milk Cattle.



A Danish Red Dairy Cow.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

been improved for dairy purposes for the last 50 years and while they are now fine dairy cattle they are not at the height of their development. Each year the milk yield average for the whole country is increased.

RED DANISH BREED—This breed has been pure since about 1850, originating, according to Morse,¹ about the same as the Red Schleswig cattle. Both of these breeds have been gradually perfected from the Angeln (Angel) breed which has been in the vicinity of the peninsula since the dawn of history. Early introduction of Shorthorn and Ayrshire from Great Britain, and Brown Swiss from Switzerland has somewhat affected the characteristics of the Red Danish breed. In fact, this breed has always been bred with the idea of a dual-purpose animal—beef and milk.

"A woody landscape, with comparatively small fields, surrounded by sheltering live hedges; a fertile, genial soil, with good grass growth, and cattle which from remote times have always been raised for their milking qualities, with full ignoring of meat production, and, in former times, with a contracted breeding increase, as also a sparse winter foddering, and finally, a certain care taken by the population in watching over the good descent of the cows on the mother's side—these are the chief points from the influence of which the ANGEL breed has been formed." (Consular Report 1887.)

This Angel breed is the basis of the Red Danish and was well developed in 1870 as a milking breed. Thus the Red Danish breed began with a breed which had always been pure and was native to the country. The speed with which the Red Danish breed has been developed also owes much to the process of selection and a ruthless culling of the less productive cows. The best cows of this breed now yield from 15,000 to 20,000 pounds of milk testing 3.8 to 4.0 per cent in butterfat.

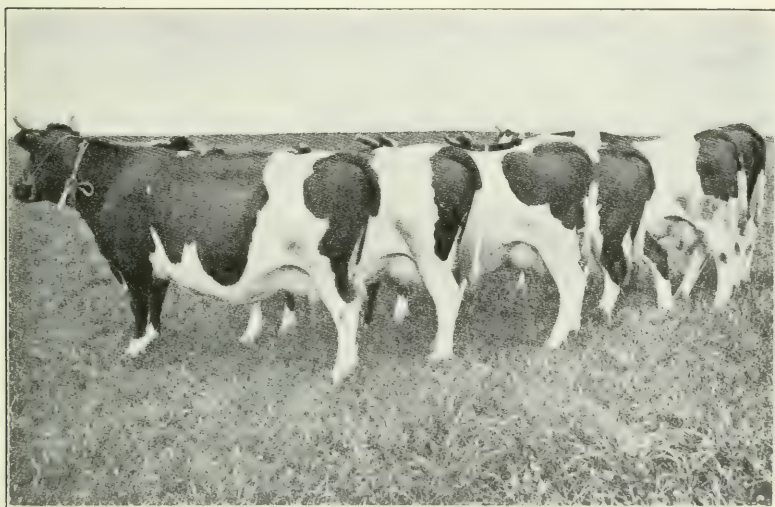
A record not usually found is that for the life of the animal, but in 1833 the cows of Denmark, weighing from 900 to 1,400 pounds, gave an average of 4,000 pounds of milk, being "life records."

The Red Danish cattle are used entirely for dairying but as soon as the cow falls off in milk she fattens easily. It is noticeable that in all European countries where beef is high in price great emphasis is placed on the beef value of dry cows.

JUTLAND BREED (BLACK AND WHITE)—This breed has

¹ F. W. Morse, "The Ancestry of Domesticated Cattle."

always been pure and has always lived in the same section of Jutland. The Jutland breed is about the same size as the Red Danish, however it was originally used only for beef. It has been improved for dairy purposes since about 1870 and the results have been encouraging, as the yield of milk for this breed in 1883 was said to average 5,800 pounds a year and has been increased very much since that date.



The Black and White Danish Dairy Cattle.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

In general form and color this breed is similar to the Black and White of Friesland, Netherlands.

The object constantly kept in view in Jutland is the development of milking qualities while retaining a broad, deep, and well-built body. This ideal is similar to the Friesian ideal.

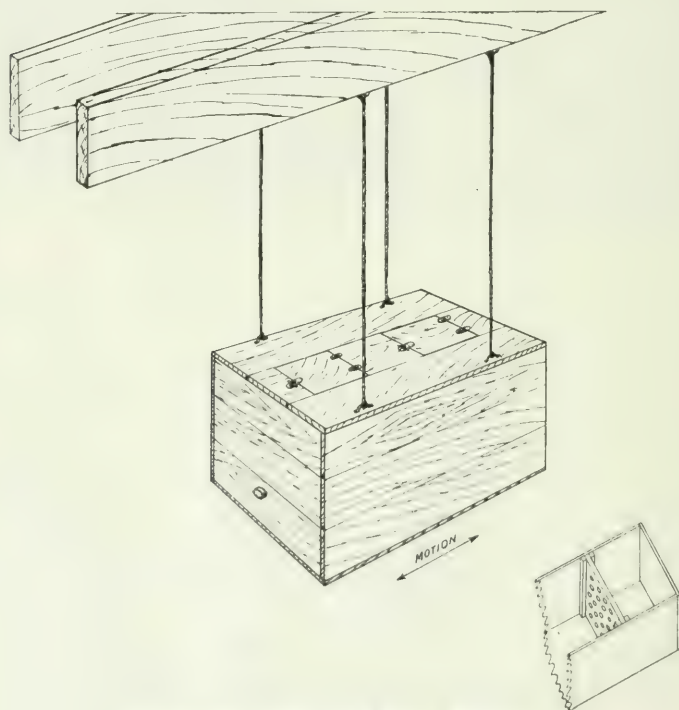
CHANGING TO DAIRYING—Denmark has always been an agricultural country depending on international markets to take the products. Until the year 1870 and even to 1880 the farmers considered the sale of grain as the principal source of their revenue while livestock had a secondary place.

Dairying began about 1830 on the large estate farms. The estate farm owners were aware of the need of increased soil fertility to increase production. The keeping of cows furnished manure

which their land needed. It was merely a question of making the keeping of cows pay. To this end it was reasoned that a large production of butter would justify the employment of a skilled buttermaker and thereby the butter would be improved to such extent that it would command a higher price. Therefore, dairy-maids were brought from the Netherlands to operate the estate dairies.

The peasants kept few cows prior to 1850. The cows were kept mainly to produce milk, butter, and cheese for the family. Incidentally the cows lived on grass in summer and were poorly fed during the winter.

The butter production on the large estates was exported to Norway and England. The butter shipped to England was generally sent by way of the Kiel Canal or through Hamburg, Germany. This was partly due to the lack of shipping facilities and partly to the bad name the Danish butter had on the London



Old Danish Churn, by Simon Hagedorn.

market, and for the same latter reason much butter was marked "Kiel butter." The farm-made butter was of inferior quality and used in general for home consumption.

As a result of the wars between Germany and Denmark, 1848 to 1850 and 1864, the Danish traders sought a direct contact with England for the sale of their produce. Direct shipping was greatly encouraged in 1865 by the establishment of a steamship line which made regular trips between Denmark and England.

In the 60s and 70s, when the Danish butter came to the English market in quantity, there were so many small lots that the testing and grading became a burden. That market desired large shipments of a single grade and was willing to pay a high price for high-quality butter. This was to the advantage of the large estate producers who shipped fairly large lots of butter and to the disadvantage of the small farmers who could ship only in small parcels at the best.

DIRECT CAUSE—During the period 1870 to 1880 American competition began to be felt, especially on grain and beef, causing a considerable fall in the price, which remained low. The price of dairy products, however, remained relatively constant. The reduced price of grain and beef necessarily led to a change in the type of agriculture to be followed in Denmark. It was not possible, as it had been in other countries, to protect the national grain production by a tariff, for the country was an exporter and not an importer. Dairying and livestock improvement must henceforth be the basis of agriculture; but this would necessitate an entire reorganization for the purpose. The large estate owners could easily increase their herds and produce dairy products, as their farms were well managed and their dairies were well-nigh perfect, but it was a difficult proposition for the small and middle-sized farm owners to make this change.

DAIRY DEVELOPMENT—The success of Denmark's dairy industry has been due largely to her geographical position between two densely populated, industrial countries—Great Britain and Germany—with great requirements for food products. These countries have furnished excellent markets; however, there has always existed a strong competition with the Dutch and French.

There were three other factors very valuable to the industry: Cattle native to the country capable of development in dairying.

people adapted to steady, careful, contented occupation, the economical urge when other lines of work became impracticable.

The change to dairying as an industry was made at a critical time. Most of the butter exported was of poor quality and the markets were exacting. As the price of grains and beef remained low the change had to be made speedily. Several attempts were made before a satisfactory system was found. The main difficulty was to make butter good enough to satisfy the English market. At this point the scientists came to the rescue and such men as Segelcke, Fjord, and Storch, handled the problems of the dairy-men with great wisdom, not only in that day but many of their methods and deductions are standard even today.

**Prof. Storch.****Niels Johannes Fjord.****Dr. Segelcke.**

Courtesy of S. Sorensen, Danish Agric. Agent.

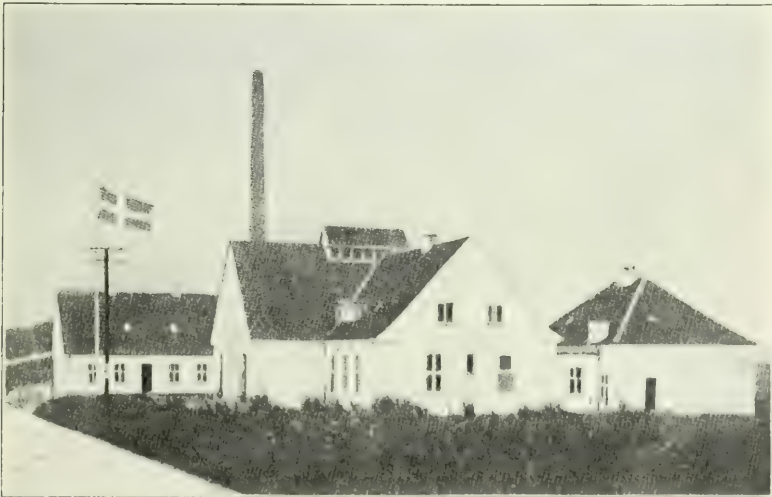
MATHIAS WILHELM SAMUEL STORCH (1837-1916) Scientist, chemist and bacteriologist. In 1872 he wrote on the "Uses of centrifugal force to shorten the time for separating cream from milk." He was associated with Fjord in 1883 in the governmental laboratory. In 1875 he published his first comparison between the butter made from sour cream and sweet cream. In 1885 he conducted experiments with udder diseases of cows; 1890 he studied pasteurization and ripening of cream; in 1896 he issued a statement of the faults of butter;

in 1898 he published a method for determining whether milk had been heated to 80° C. (176° F.) which was later used in tuberculosis eradication.

PROFESSOR TH. R. SEGELCKE (1831-1902) Chemist and dairy expert. In 1860 he was employed by the Royal Agricultural Society as dairy expert; in 1873 appointed professor of dairying which position he held until his death. Mr. Segelcke introduced the use of the thermometer and weights and measures in the manufacture of butter and otherwise applied scientific methods to the dairy industry. He was a judge of dairy products at the World Exposition in Philadelphia, Pa., in 1876.

NIELS JOHANNES FJORD (1825-1891) Lecturer in physics in 1858; in 1872 he suggested a small steam boiler for use in dairies; in 1874 studied and published data on ice house construction and shrinkage of ice; with Dr. Storch he studied the creaming of milk by the shallow-pan method and cooling by ice or by water; for butterfat testing he devised a machine similar to the Babcock or Gerber testers; urged a large governmental laboratory; invented the "Fjord pasteurizer," recommended refrigeration on railways and ships. His studies included the use and control of temperatures in buttermaking, and many feeding problems.

COOPERATION—As a remedy to the marketing difficulty the farmers of the small and middle-sized farms, without any help



Typical Danish Cooperative Creamery.

Courtesy of S. Sorensen, Agric. Agent.

from the large estate holders or other philanthropic leaders, originated the cooperative idea. It came as an economic necessity to

answer the marketing situation and was believed to furnish a solution to the desire for a standardized quality of butter.

Cooperative butter-packing houses were first tried. These houses were erected by stock companies and also by farmers. The butter made on the small farms was sent to the packing house where it was sorted, blended, or repacked, in an effort to make a uniform product for export. The system was not a success, as the butter at best was not first class and the repacking was wasteful and harmful to the butter.

The creamery system was the next step used to overcome the fault of ununiform butter. Creameries were built in the 70's but while they were begun as cooperative plants they soon became private property.

The first factory organized on cooperative plans was started by a few farmers near the village of Hjeddning, West Jutland, June 10, 1882. It succeeded and soon there were many cooperative plants throughout the country. These creameries received the milk from the entire neighborhood and manufactured it into a standardized product in sufficient quantities to obtain the highest price on the London market. The factories were equipped with the best machinery obtainable. Thus the small farmer as a member of the local cooperative creamery was able to get just as much for his milk as the large estate farmers.

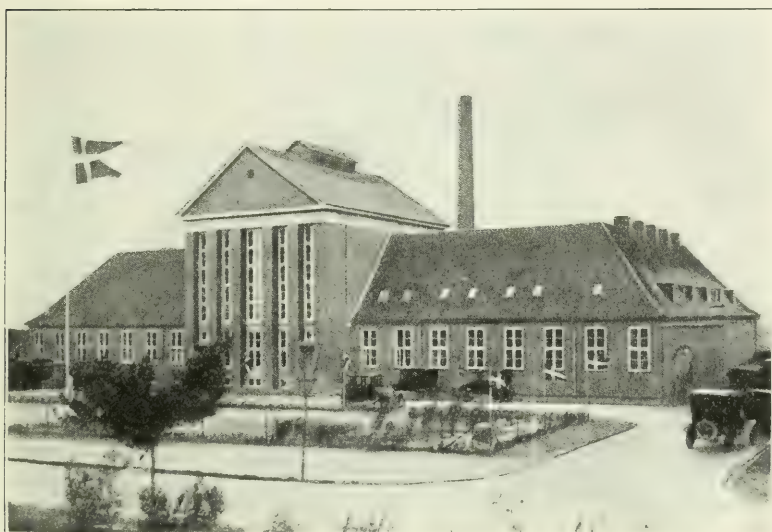
The growth in number of cooperative creameries was remarkable in the first few years after the first factory was established. Eighty were begun the first 5 years—1882-1886; 595 from 1886 to 1890; 153 from 1891-1895; and 110 from 1896-1900, and in 1914 there were in the country 1,168 cooperative creameries receiving practically 90 per cent of all the milk made into butter. While this was in progress the number of estate factories declined from 264 in 1900 to 16 in 1914. The cooperative creameries operate (1924) on the milk from an average of a little less than 1,000 cows or from 3 to 6 million pounds of milk per year.

The next step was to get buttermakers skilled enough to operate all the creameries successfully. The agricultural schools set about to produce them and special courses were given in butter-making and creamery management.

FEDERATION OF COOPERATIVES—The cooperative creameries are organized into 23 district service organizations, and these

are again organized into three provincial organizations. The three provincial associations form the national association or federation of creameries.

The national federation of Danish creameries acts for the common good of all creameries at home and abroad. The federation



Experiment Station.

Courtesy of S. Sorensen, Agric. Agent.

has a committee on the Danish butter quotation board, and another on statistics which supervise the activities of Denmark's dairy statistical bureau.

The Danish creamery manager's society, founded in 1887, is an organization among the managers of the creameries. The society produces the only strictly dairy journal in the country, "Malkeritidende." A committee of this society in connection with the national federation compose the committee on minimum-wage scale.

THE COPENHAGEN QUOTATIONS—These butter quotations are important, as they are the basis for selling Danish butter for export, and also for the settlement with the creameries furnishing the butter. The creamery managers use the quotations for

advances in payment for milk from patrons. All sales of butter are on these quotations. These quotations are fixed as follows:

Two committees meet each Thursday at 2 p. m. and agree or compromise on a price for butter. One committee is composed of butter merchants and the other is of the producers. The actual price at which Danish butter sells on foreign markets is the basis for the established price each week; however, it is supported by a knowledge of the trade demands.

The first butter quotations were made by a farmers' union in 1894 and soon after taken up by the dairy unions.

LUR BRAND—As early as the 90's the farmers began a movement to have the creameries use a common trade-mark including the words, "Lur brand" and "Danish butter." Swedish, Finnish, and Siberian butters were being bought by Danish merchants and reexported as Danish butter. Finally a single dairy asked authorization to use the Lur brand trade-mark and then gave others the right but obligated itself to take legal action against any creameries not authorized to use the trade-mark. This was in 1900. A law was passed in 1906 establishing the Lur brand as the national trade-mark, and in 1911 an amendment made it unlawful to export butter without that trade-mark.

The law is intended to guarantee the butter to be manufactured from cream or milk which has been pasteurized at least at 170 degrees F. and to contain not more than 16 per cent of water. Creameries using the Lur brand are supervised by government experts. Any creamery not meeting the requirements is not permitted the use of the trade-mark and its butter, therefore, can not be exported.

The butter is packed in casks (Drittel) each holding 112 pounds.

The first cooperative export society was organized in 1888. Its purpose was to export the product of a large number of creameries, as Danish butter is not sold on exchange but goes direct from the creameries or export warehouse to the retailers or dealers in England and Germany. In 1924 the cooperative butter export association exported a total of 82,000,000 pounds of butter, or 38.8 per cent of the total production.

Large English wholesale firms have representatives in Denmark which buy butter direct from the creameries and make shipment to England without it passing through other hands.

Some of the Danish merchants buy butter direct from the creameries and ship to foreign markets. These private merchants handled nearly one-third of the butter exported in 1924.

For many years one large cooperative consumers' society of England has bought butter direct from the creameries for its own members. Thus it is seen that the exportation of butter is neither

WHAT ARE

CONSUMERS OF "LUR BRAND"
DANISH BUTTER GUARANTEED

?

They obtain: *BUTTER* free of tuberculosis.
BUTTER containing less than 16 % of water.
BUTTER containing no detrimental preservatives.
BUTTER of the very best quality.
BUTTER of equally quality all the year round.
BUTTER in equally quantity every week.

centralized nor under control of the cooperative factories. There are 11 cooperative exporting associations and while they do not operate as a single body they maintain the standards and regula-



Barrels Employed for Packing "Lur Brand" Danish Butter.

tions prescribed for the exportation of butter. These associations have each an office and warehouse to which the butter is brought from the creameries. The butter is then pooled and sold by the association for the creameries. (Christensen).

All butter made during one week is shipped the first of the next week.

BULL ASSOCIATIONS AND MILK RECORDING ASSOCIATIONS (COW-TESTING ASSOCIATIONS)—As soon as dairying began to show signs of success resulting from the cooperative system of operating factories, greater production was the next important problem. Theory and practice worked together for the answer. Professors Th. R. Segelcke and N. G. Fjord, of the higher agriculture and veterinary school, experimented with dairies of the large estate farmers in connection with the experiment station on many of the creamerymen's problems. Professor Segelcke introduced the practice of weighing the milk delivered to factories, weighing cream that was churned, and the use of the thermometer instead of the finger to determine temperatures. He called attention to the keeping of records of cows, crediting each with the milk produced and charging for the feed consumed.

Improvement of livestock through cooperative breeding (bull) associations has had marked success from its beginning. According to Professor H. Larsen the number of milk cows from 1881 to 1914 increased 45 per cent and the total production of milk increased 150 per cent. Breeding associations were organized for the purpose of bringing better sires into each neighborhood. The government was quick to recognize the benefit of such organizations and in all Denmark's cooperative activities the breeding and cow-testing were the only ones that received government financial help. This financial help, which amounted to some \$65 for each cow-testing association, was available only on conditions—there must be at least 8 members in each organization, owning 200 cows.

The first bull association was formed in 1884. The association was started by a tenant, J. M. Friis, assisted by an estate farmowner, Fr. Hvass. The purpose was to organize associations in each community for the improvement of the dairy cattle. In order to receive government aid the society must have at least 10 members, and have inspection of bulls and cows by a veterinarian. Further aid was also accorded if the bull met the required standard of the state agricultural show.

The number of bull associations grew rapidly and in 5 years there were more than a thousand associations. In 1921 there

were 1,446 bulls belonging to these associations, which is nearly one-third of the total number of bulls in the country.

COW-TESTING ASSOCIATIONS (MILK-CONTROL SOCIETY)—The first cow-testing association was formed by 13 farmers in the neighborhood of Vejen in 1895. It is probable that this was the first association of this kind established in the world. The association was cooperative and a man was hired to make the test of the milk of each cow and keep a record of the feed of all cows owned by the members. The agricultural schools soon put in courses of study to fit men for cow-testing work. The leader in the agricultural college work was Niels Pedersen.

Possibly no undertaking in dairying has been more successful than cow testing. It spread rapidly throughout the country and to foreign countries. In Denmark, in 1922, there were 821 associations and 295,290 cows under test, which was 22.5 per cent of all the cows in the country. In 1924 the number of associations was 1,038 with a total of 394,181 cows. The yield of the cows in Denmark was 4,354 pounds in 1898 and in 1924 it was over 6,000 pounds and the credit is all due to the cow-testing associations.

CENTRIFUGAL CREAM SEPARATOR—The separation of cream from the other portions of the milk had been obtained by the gravity method by the use of shallow pans and later by the Cooley system of deep cans set in cold water. These methods required much time and large floor space for the setting of numerous pans. The usual custom was to set the milk in pans, crocks, wooden vessels or tubs in cool cellars or milk houses constructed partly under ground. In 12 hours the cream would rise and was skimmed by hand and poured into other vessels or cans which were taken to the creameries. About 1870, inventors became very much interested in the problem of making a cream separator. Like most other complicated mechanical inventions the separator was not invented at once in its final form. The cream separator can not be said to have obtained its final form until it was so constructed that a continuous stream of milk ran into it and a stream of cream and another of skim milk ran out of it. A Danish engineer, Winstруп, made a separator in 1876 and a German, Lefeldt, had one in operation the next year, but neither was con-

tinuous. They let the cream run out but the separated skim milk remained in the cylinder, and the machine had to be stopped to remove the separated milk.

The first continuous working cream separator was designed by L. C. Nielsen, of Roskilde, and was installed in a dairy in Copenhagen, in 1878. The following year Dr. De Laval of Stockholm, Sweden, brought out his famous machine, which was the first successful continuous one and it has been very popular ever since. It was not until 1880 that Lefeldt invented a continuous machine. Some of the inventors had been working on this subject for more than 15 years.

The great advantage of the use of the cream separator was, first, in the saving of time in creaming the milk, the usual 12 hours was cut down to an hour. There was also a saving of cream, as the separator produced about 10 per cent more cream than the gravity method. It also removed much of the drudgery from the home of the farmer, as the milk could be cooled immediately and delivered to the creamery where it was separated and all the skim milk, sweet and pasteurized, was immediately available for feeding to the animals.

The cream separator at first was not so popular as later, due to the farmers' not being familiar with separated milk for use as calf and pig feed. Here again the scientific investigators proved their worth by establishing the proper methods to be used in feeding the skim milk and in teaching it to the farmers. Now all the skim milk is returned to the farmers for calves and pigs; hence, the bacon industry becomes a part of the dairy industry.

OTHER DAIRY PRODUCTS—The production of other dairy products is also encouraged but not to the same extent as butter. Cheese has always been made in Denmark but until recent years the production was not equal to the consumption; hence, there was a large import. The principal cheese made is similar to the Cheddar cheese made in England, but not exactly like it. This Danish cheese is made with 20, 30, 40, and 45 per cent fat content. Each cheese must be marked with the exact per cent of fat it contains. Imitation Roquefort, Swiss, and Edam cheeses are also made for export.

The home consumption of cheese is from 12 to 15 pounds per person a year.

The export of cheese in 1914 was only 9 million pounds but in 1924 it was 19 ½ million pounds. Most of the cheese was sold in Germany.

The first to manufacture rennet extract was Chris Hansen, who had it on sale in 1873 and since that time it has been sold in all parts of the world.

Condensed milk, sweetened and unsweetened, has been produced for years. The cooperatives also manufacture this product and the export in 1913 amounted to more than 6 million pounds, while in 1923 it was 67 million pounds.

The production of casein has received attention and the exports of this product amounted to 767,000 pounds in 1914, but since that date it has decreased.

OTHER COOPERATIVE ORGANIZATIONS—The close culling of the herds for the improvement of dairy stock makes it practicable to dispose of a large number of calves, undesirable heifers, and bulls, as well as old, discarded cows. For the purpose of realizing the most from such a miscellaneous lot of cattle there was established a cooperative cattle-export association, in 1898.

Cooperative buying associations and cooperative consumers stores have been founded. The cooperative buying of feeds, seeds, fertilizer, and machinery have a place. Credit associations were also among the important ones for the use of the farmer in the financing of his many activities.

As early as 1898 these cooperative federations had formed a central cooperative council. All this maze and interlacing of cooperative organizations has purpose and system in its trend, i. e., the completion and development of the services needed, thereby making the dairy industry a perfect unit without the aid or assistance of other industries.

METHODS AND PRACTICES—The following description of a large farm near Copenhagen is a clear picture of the usual type of farm in Denmark:

"Four low, brick buildings were built about an open court which contained the well and a large Danish pump. The living apartments constituted one side of the square and stood nearest the road. On the opposite side was the long, brick cow barn, which had a small loft for hay. A machine shed on the third side of the court and a hay barn on the fourth completed the en-

closure. The cow barn housed 48 head of cattle stanchioned in two rows facing a center feeding alley. Concrete floors and mangers helped to make it possible to keep the barn sanitary. The mangers were used also as drinking troughs, water being piped to them from the large, awkward pump in the courtyard." (E. M. Clark.)

During the summer months the cows graze on the artificial pastures, which comprise about $3\frac{1}{2}$ million acres of various grasses, including clovers and lucerne (alfalfa). The cows are fastened



A Modern Danish Farm.

Courtesy of S. Sorensen, Agric. Agent.

to stakes, ropes being attached to halters; they are moved several times a day but generally kept in a row across the field. In the natural meadow districts the cattle are turned loose for grazing. The winter lasts about 7 months and the cattle are fed on dry forage, roots, and concentrates. The cakes most used are those made from cottonseed from the United States, sun-flower seed from Russia, soy bean and cocoanut and linseed. As much as 8.8 pounds of cake is given each cow in the daily ration. Beets and swedes are kept in silos (pits) covered with soil. The water is furnished by a pump and windmill on only a few farms as the water is generally pumped by electric or hand power.

The cows originally calved in the spring but in later years

they calve in the spring and in the fall in order to have a constant flow of milk throughout the year.

CARE OF MILK — Milking is very carefully performed, generally by hand. The milk is put into cans containing from 5 to 10 gallons which are gathered daily by the cooperative creameries. The cans are returned to the farmers with the skim milk or whey. No hand separators are used in this country at the farms, hence the whole milk is delivered to the creameries. The milk is kept in large cans in cold water until called for by the collector, which is between 7 and 10 o'clock each morning. When the milk is received at the creamery it is pasteurized at 85 degrees C. (185° F.).

The cooperative organizations have strict rules for their members. The delivery is to be made each day, the milk to be sweet and in good condition. The members sign a contract to deliver all the milk to the cooperative factory not needed for family use or sold locally at retail. The quantity of milk used on the farm for household purposes is estimated by the Statistical Bureau at 330 pounds per cow a year.

FEEDING—On large farms the feeding and care of the cattle occupies about two hours of the morning and two hours in the evening, including the milking period. On many of the smaller farms the milking is done three times a day.

The feeding is begun at about 6 a. m. and concentrates are fed first, followed by the root and then by the hay and water, and lastly by straw. About 4 p. m. this is again repeated.

During the winter the cows remain in the barns all the time.

The grass season is from May to October.

The calves are fed during the first two weeks on whole milk; but at the end of that time skim milk is mixed with the whole milk, gradually increasing the skim milk and decreasing the whole milk until they get no whole milk at all, and when about 10 weeks old the skim milk is partly substituted by whey and bran. This with hay and straw in winter, and grass in summer forms the feed of the calves. The following winter they get roots in addition to hay and straw with a little grain. The heifers are bred when 15 months old to calve when two years old.

Consumption of Dairy Products—BUTTER—There are few statistics throwing light on the amount of butter consumed annually but in 1914 the average consumption per person was 17 pounds. Bread and butter form an important part of the diet of the people. All through the spring and summer, from March to November, it is customary among the farmers and working classes to eat a lunch of bread and butter and cold meat or cheese in the middle of the forenoon, and another in the middle of the afternoon. At the regular meals of breakfast, dinner, and supper, bread and butter are also eaten freely. Butter is used some in cooking.

The consumption of butter varies according to the needs for exportation. Danish export butter is the money producer for the farmer and any shortage in butter is reflected more on the home consumption than it is on the export trade.

CHEESE—The consumption of cheese averages about 12 pounds per person in normal times. The cheese is consumed largely in the form of sandwiches. For years the consumption of cheese was equal to or greater than the production but in recent years the production has forged ahead and now the exports amount to nearly 20 million pounds per year. Most of the cheese eaten in Denmark is the skim or partly skimmed type and its manufacture, therefore, does not seriously interfere with the production of butter.

CONDENSED MILK—The consumption of condensed milk is increasing rapidly. The production for 1924 was 119,048,000 pounds, of this amount there were exported only 71,198,000 pounds, leaving available for consumption 47,850,000 pounds.

CONSUMPTION AND PRODUCTION OF MARGARINE—Both animal and vegetable margarine are made in great quantities but principally for home consumption. In fact it has been only in recent years that margarine was permitted to be exported. This was to prevent the sale of margarine in foreign countries from affecting the good name of Danish butter.

Margarine is consumed for two reasons: One is that it is cheaper than butter and therefore is used by all classes for economy. The other reason is found in the fact that the consumption of margarine makes available a greater quantity of butter for export.

The consumption of margarine in the period 1891-1895 aver-

aged per year, 18,524,000, or 8.69 pounds per capita. For the period 1906-10 it was 69,960,000 pounds, or 25.7 pounds per capita. In 1915 the consumption amounted to 124,054,000 pounds, or 41.9 pounds per capita. In 1923 the per capita consumption was 42.7 pounds.

The number of factories that made margarine was 42 in 1913 but it increased to 120 in 1924, making 153,058,764 pounds.

During the World War the production of margarine decreased from lack of raw materials from which to manufacture it. During 1918 margarine was made in so small quantities that it was permitted for use only for cooking purposes. The people of Denmark consume normally about 18 pounds of butter and 30 to 40 pounds of margarine each year per person. During the war much of the butter could not be exported and therefore took the place of margarine in the home consumption. During 1918 the average consumption of butter was 32 pounds per person, having completely displaced margarine for that year and, possibly, made the highest record for all countries in per capita consumption.

EFFECT OF THE WORLD WAR ON THE DAIRY INDUSTRY—The location of Denmark geographically, which had been so advantageous for dairying, was equally disastrous during the World War. England and Germany each restricted the sale of food products as much as possible to the other nation and hence in a short time Denmark's trade in dairy products was very much limited. Not only were the dairy products in danger of seizure but the importation of feedstuffs was stopped. Since the year 1882 feedstuffs had been imported in excess of exports and in 1913 more than 3 million pounds of oil cake, bran, corn, and other grains were imported for feeding. The home production of feeds had increased 85 per cent since 1880 but supplied only 60 per cent of the requirements. When these imports were cut off Denmark was in no position to do otherwise than reduce her livestock to that level.

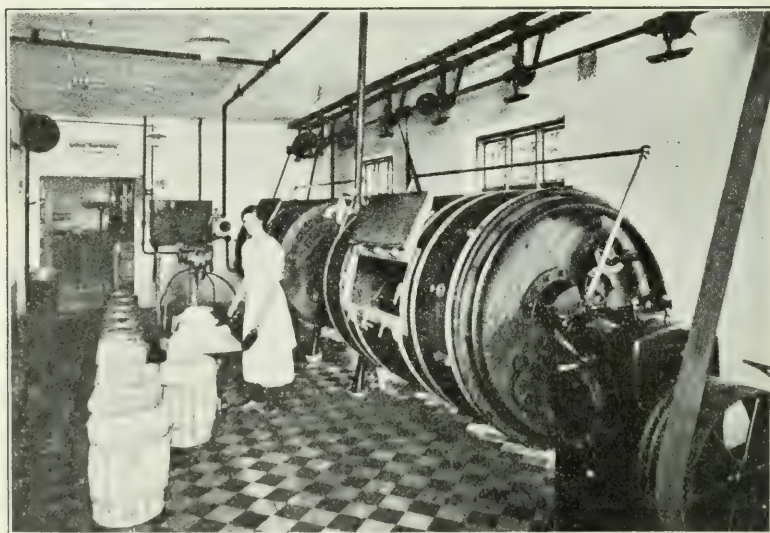
At an early date the government formulated a policy which favored the dairy cattle and reduced the other stock. A closer culling of the dairy cows was encouraged.

The exportation of cream had long been a valuable part of the industry but with the war conditions this was discontinued.

The cream usually exported was turned into butter, which accounts in part for the rapid increase in butter production.

The government set up food-rationing regulations and butter cards were issued which permitted the consumption of 250 grams ($\frac{1}{2}$ pound) of butter per week. Prices and profits were fixed for butter but the industry was seriously handicapped. These conditions existed until 1919 when the Allied and American restrictions were removed from feedstuffs to Denmark. Then the dairy industry began to recover and it is remarkable how rapidly the progress was made. In 1923 the production of milk was equal to that of 1914.

EXTENT OF THE INDUSTRY—The milk production of the one and one-third million cows amounts to seven and one-third billion pounds a year. The milk is rich, containing about 3.6 per cent butterfat. The population is furnished annually with nearly 70 gallons of whole milk each and the remainder is manu-



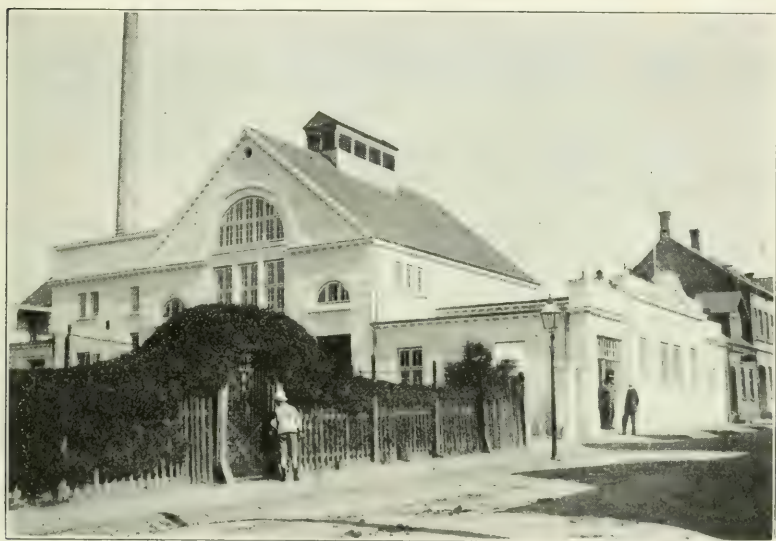
The Interior of a Creamery, Buttermaking Room.

Courtesy of S. Sorensen, Agric. Agent.

factured into butter, cheese, and condensed milk. More than 300 million pounds of butter are made and 275 million pounds of it are exported. The cheese production consists of whole milk, part

skim, and full skim cheese, which is consumed principally within the country, but about 20 million pounds are exported, mainly going to Germany, although the imitation Roquefort is quoted and found regularly on the English market. Condensed milk is manufactured, and now amounts to 120 million pounds a year, most of it being exported.

The skim milk and whey from the factories are returned to the farms and are fed to pigs and calves. Pig raising is considered



Creamery and City Milk Plant, Denmark.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

a part of the dairy industry. Just prior to the war the slaughter of pigs averaged $2\frac{1}{2}$ million a year.

IMPORTS—Prior to the development of dairying, butter and cheese were imported in large quantities. The butter was imported for home consumption or for reexport as Danish butter. It was to stop this practice that the national trade-mark was first-planned. These imports were generally from Sweden, Norway, and Russia.

OUTLOOK—At the present time dairying is the principal industry in Denmark. Most of the other industries are built more or less about it. In its 40 years of development it has passed

through many stages of organization and finally perfected one which has proved to be very much suited to the people and to the industry. It has passed from pioneer methods of individual farms to the highest scientific, factory methods. From individual selling it has passed through all the steps to federated pooling of products; from the miscellaneous assortment of butter offered the markets to a standardized product, fully guaranteed, and receiving the highest price of all markets. From the native cow with a small yield of milk it has passed to a well-developed cow giving large quantities of milk, rich in butterfat, and maintaining a well-developed body. The peasants have passed from serfdom to farmers owning the farms and trained to this specialized type of farming and in the management of their own cooperative organizations. It has passed from individual effort to the highest type of cooperative management.

Denmark has done much for the dairy industry and has given to the world correct ideas and fine examples but, possibly, her greatest gift to dairying is the placing of the responsibility for the success of the industry on the shoulders of the farmers. This was done by the cooperative system, in which each member is jointly and severally liable for the success of his association. Thus the farmer is responsible for the success of his own business, both productively and in marketing, and it is further demonstrated that the two functions, production and marketing, are inseparable.

Dairying has the first place. Government approval and support have been obtained. The dairy cattle have been developed and breeding societies formed to maintain the highest type of dairy animals. Cow-testing associations really standardize the herds and cull out the poorer animals, which are sold only for slaughter through cooperative agencies. The dairy products have been standardized and cooperative creameries have adopted regulations which make it possible to keep abreast of the latest achievements. Subsidiary industries also have been systemized until they work in perfect unison with dairying.

CHRONOLOGICAL EVENTS

YEAR

- Earliest History—Two breeds of cattle in Denmark, Angel and Black and White.
- 1733 Peasants under feudal bondage at this date.
- 1769 Royal Agricultural Society founded, to advance agriculture.
- 1788 Oppression of peasants by large land owners ceased.
- 1830-40 Dairying begun by the large estate holders
- 1843 Shallow pan used for creaming.
- 1848-50 War with Germany.
- 1850 Farm tenancy began decreasing.
- 1850 Peasants becoming interested in dairying.
- 1850 Direct shipments of butter to England begun.
- 1858 Royal Agricultural School in Copenhagen started.
- 1861 Average milk yield 220 gallons per cow.
- 1864 War with Germany.
- 1865 Steamship line established between England and Denmark.
- 1870 Prof. Th. R. Segelcke introduced the use of the thermometer in dairying.
- 1870 Improvement begun on the Black and White breed for dual-purpose cattle.
- 1870 Danish butter has bad name on the English market.
- 1870-80 Severe competition from America on grains and beef.
- 1873 Chr. Hansen began the manufacture of rennet extract.
- 1878 Cream separator invented by L. C. Nielsen.
- 1882 The first cooperative creamery established.
- 1883 Milk laboratory established in Copenhagen.
- 1884 First bull association formed.
- 1885 First livestock improvements society founded.
- 1887 "Malkereitidende" paper started.
- 1887 Association of technical managers started.
- 1888 First butter export society formed.
- 1890 Dairy high school established in Copenhagen.
- 1894 Butter quotation board established.
- 1895 Cow-testing association first established, using Prof. Hansen's method.
- 1898 Law passed compelling all separated milk and buttermilk to be pasteurized.
- 1898 Central co-operative council established.
- 1900 "Lur Brand" trade-mark for butter established.
- 1901 Collective purchase society of the dairies established.
- 1903 Balance sheet for farm expenses started.
- 1903 Creamery statistical committee established.
- 1904 All cream for buttermaking required to be pasteurized.
- 1911 Lur brand became national trade-mark and was compulsory for all butter to be exported.
- 1912 Government grants financial assistance to cow-testing associations.
- 1914 World War.
- 1914 Cooperative creameries receive about 85 per cent of total milk.

- | | |
|------|--|
| 1914 | Average milk yield 605 gallons per cow, annually. |
| 1915 | Co-operative rural bank begun. |
| 1917 | Federated Danish co-operative association established. |
| 1924 | Denmark exported 90 per cent of all butter made. |

NUMBER OF DAIRY COWS AND TOTAL CATTLE
(Statistisk Aarbog, and Statistik Arsboek)

Year	Dairy Cows	Total Cattle	Year	Dairy Cows	Total Cattle
1876	898,012	1,348,321	1918	1,024,417	2,123,722
1881	898,700	.....	1919	1,042,143	2,188,142
1883	1,011,098	1,696,190	1920	1,112,963	2,286,408
1903	1,089,073	1,840,466	1921	1,184,268	2,591,000
1909	1,281,974	2,253,982	1922 ²	1,310,893	2,525,343
1914	1,310,268	2,462,862	1923 ³	1,349,365	2,537,393
1915	1,281,132	2,416,471	1924	1,368,000	2,667,000
1916	1,141,246	2,289,996	1925	1,390,000	2,756,000
1917 ¹	1,147,183	2,458,158	....	.....	.....

¹ Beginning with 1917 the year is for July 15.

² Including new boundaries.

³ Number of calves under one year 646,222.

AVERAGE YIELD OF MILK, AND TOTAL MILK AND BUTTER PRODUCTION
(Official Reports)

Year	Milk Yield Per Cow	Total Milk Production	Butter Production
	Pounds	Thousand Pounds	Thousand Pounds
1888	3,858	3,681,497	.....
1898	4,354	4,646,872	.....
1900	5,196	5,503,444	.....
1906	5,657	6,700,000	(1905) 209,153
1909	5,816	7,455,960	.....
1912	5,558	7,204,000	.....
1914 ¹	6,159	7,937,552	257,484
1915	5,996	7,568,000	242,506
1916	6,047	6,710,000	220,460
1917	5,647	6,325,000	187,391
1918	4,153	4,571,600	127,867
1919	3,985	4,188,000	134,481
1920	5,052	6,614,000	198,414
1921	5,848	6,926,000	227,000
1922	5,952	7,369,840	253,529
1923	.....	.....	304,235
1924	.....	.....	308,000

¹ Beginning with 1914 330 pounds were added to yield for home consumption.

NUMBER OF COOPERATIVE CREAMERIES
(Official Reports)

Year	Number	Year	Number
1882	1	1914	1,168
1891	800	1918	1,200
1900	1,029	1922	.....
1906	1,056	1923	.....
1909	1,157	1924	.....

IMPORTS AND EXPORTS OF BUTTER, AND AVERAGE PRICE
(Vareindførsel og udførsel; Statistisk Tabelværk;
Statistisk Meddelelser)

Year	Imports	Exports	Copenhagen quotation
	1,000 Pounds	1,000 Pounds	Cents
1866	Not given	10,710	16.88
1870	Not given	13,805	19.83
1880	Not given	27,058	24.12
1890 ¹	20,550	98,167	24.39
1900 ¹	46,701	131,100	26.80
1910	6,241	195,052	26.26
1911	6,027	197,482	30.55
1912	5,966	187,755	29.48
1913	6,242	200,670	29.75
1914	3,054	210,084	25.80
1915	687	223,964	32.30
1916	191	211,090	38.90
1917	1	135,502	49.00
1918	.....	32,306	65.70
1919	441	80,622	59.80
1920	6	164,959	45.20
1921	402	202,953	38.10
1922	1,174	210,557	36.60
1923	1,593	246,157	36.80
1924	2,048	272,033	39.60
1925	.....	271,915	42.50

¹ "General Imports for 1890 and 1900, Quotations at current rate of exchange.

IMPORTS AND EXPORTS OF CHEESE, CONDENSED MILK AND CASEIN
(Vareinførsel og udførsel)

Year	Cheese ¹		Condensed Milk ²	Casein
	Imports	Exports	Exports	Exports
	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds
1913	1,477	661	6,393	.....
1914	1,058	1,067	5,895	767
1915	849	9,480	7,643	112
1916	320	9,833	7,224	37
1917	40	13,081	5,115	234
1918	.....	7,025	3,137	168
1919	385	5,725	3,812	75
1920	132	21,281	13,793	56
1921	521	27,653	37,523	18
1922	1,194	19,674	50,293	51
1923	721	12,038	66,969	187
1924	673	19,532	71,198	275
1925	.....	19,500	.....	...

¹ Not including Margarine Cheese.

² Including Milk Powder.

TOTAL PRODUCTION OF CHEESE

Year	Production 1,000 Pounds
1905.....	33,686
1914.....	34,346

NUMBER OF BULL ASSOCIATIONS AND COW-TESTING ASSOCIATIONS
(Landøkonomiske Aarbog, 1922; Statistiske Meddelelser)

Year	Bull Associations		Cow-testing Associations	
	Associations	Bulls	Associations	Cows
1895	.....	.....	1	.....
1900	634	710	180	76,140
1901	.....	.....	242	100,500
1902	.....	.....	262	110,800
1903	.....	.....	308	136,800
1905	1,095	1,369	415	159,600
1909	1,259	1,464	519	224,837
1910	1,260	1,463	.....	.....
1911	1,145	1,325	.....	.....
1912	1,072	1,228	.....	.....
1913	934	1,123	.....	.....
1914	911	1,104	633	222,600
1915	925	1,048	.....	.....
1920	.....	.....	673	223,300
1921	1,274	1,446	752	261,510
1922	.....	.....	821	296,290
1923	.....	.....	.....	.....
1924	.....	.....	1,038	394,181
1925	.....	.....	.....	.....

AVERAGE PRICE OF BEST DANISH BUTTER 1821 to 1870
(Danish Dairying, Jens Waring)
(Converted at par)

Years	Cents per Pound
1821-1825.....	6.96
1826-1830.....	8.04
1831-1835.....	8.04
1836-1840.....	9.38
1841-1845.....	9.65
1846-1850.....	10.18
1851-1855.....	13.40
1856-1860.....	16.80
1861-1865.....	15.81
1866-1870.....	18.76

ICELAND

(Belongs to Denmark)

NATURAL CONDITIONS—Iceland was discovered and colonized by the Norwegians in the 9th century. It lies in the Arctic Ocean between parallels of latitude $63^{\circ} 24'$ and $66^{\circ} 33'$ north. The area is about 39,756 square miles and its population was 94,697 in 1920. Its climate, while generally cold, has short summers and is changing, as grains which were raised there 300 years ago can not be grown now. The lowlands are covered with grass, herbs, and moss which are quite luxuriant. The lowlands are in the southern part of the island while the remainder is high, precipitous, and generally barren.

CATTLE—According to the International Institute of Agriculture, Rome,¹ a study of 2,739 cows coming from all the different districts of the island except Osland, from the records of the cow testers of the cow-testing associations, shows there were 11 different colors and 19 shades. These range all the way from red, which predominated, to black, white, gray, striped, and spotted. The striped animals considered to be of Jersey origin, probably descendants of cows imported by the Irish monks who were already settled in Iceland when the Normans landed there. This type of cow is to be found chiefly where the monks had their monasteries and the milk has a high fat content. The yield of milk, as shown by the cow-testing associations, is as follows:

"The maximum yield obtained was 9,317 pounds with 3.42 per cent butterfat (average of three years); the maximum fat content was 4.53 per cent for 8,015 pounds of milk in one year. One cow during 10 years gave an average of 7,821 pounds of milk with 4 per cent fat."

¹ International Review of Science and Practice of Agriculture, Sept. 1912, p. 1176.

NUMBER OF CATTLE, SHEEP, AND GOATS IN ICELAND
(Statistical Yearbook of Denmark and British
Statistical Abstract, 1912)

Year	Cattle	Sheep	Goats
1907	24,367	526,195	581
1908	23,413	512,418	520
1909	24,755	557,127	561
1910	26,338	578,634	660

In 1912 30 small dairies (creameries) were run on the cooperative plan, but the total export of butter for 1912 was only 353,400 pounds; in 1910 it was 3,000,000 pounds as compared with 286,700 pounds in 1905.

THE NETHERLANDS

"On that scrap of solid ground rescued by human energy from the ocean were the most fertile pastures in the world. In a single village 4,000 kine were counted. Butter and cheese were exported to the annual value of \$1,000,000. The farmers were industrious, thrifty, and independent."—Motley.

NATURAL CONDITIONS — The Netherlands is a country not wholly given over to dairying, but dairying is well adapted to that country, and practically to every part of the country. It



Scene in Netherlands.

has many other industries but dairying is one of the oldest and greatest. Nearly all the factors advantageous to dairying are found in the Netherlands, namely, the soil, the climate, forage, and grasses, location, and a people suited and trained to the needs of the industry.

Surface—The surface of the Netherlands is, in general, quite level. Much of the land bordering the sea has been taken from the sea and is held by great dikes which prevent the sea from coming in. The large rivers also have dikes to keep the water from spreading out over the land, which is lower than the rivers. In the sections which are lower than the sea level all rain water not taken up by the land must be pumped over the dikes. This pumping was originally done by the windmills but now steam engines and electric power are rapidly replacing the windmills. The highest ground is simply low hills which occur near the German border. The Rhine River runs through the southern part of the country from east to west, cutting off nearly one-fourth of the country.

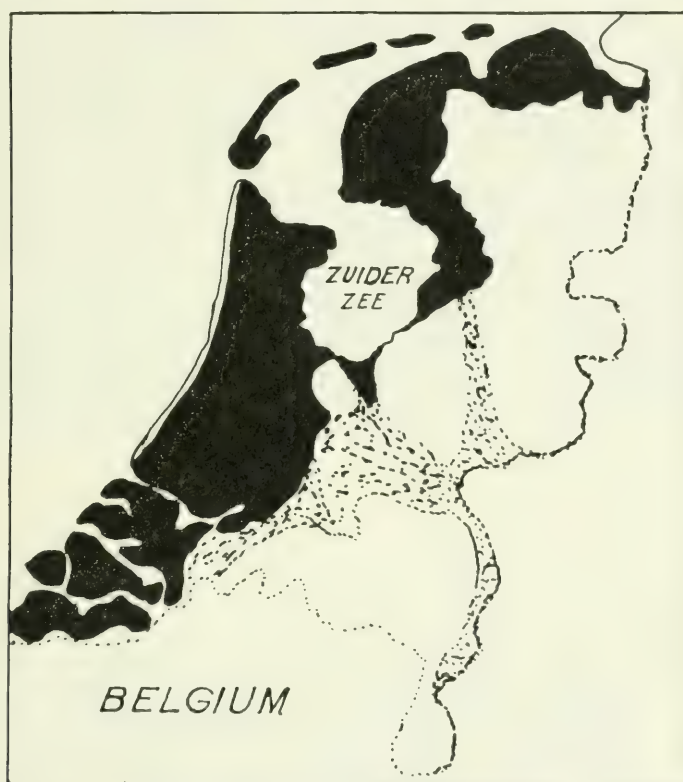
The country contains hundreds of square miles of grass land, absolutely flat, and broken only by the canals, the farmers' houses, and a few villages, while the meadows are everywhere scattered over with black and white milk cows.

Soils—All the soils of this country are not suitable for pasture lands. The kinds of soils are varied in practically every province. The lowlands along the coast have a rich, alluvial-clay soil. The fen districts are in the center and south. There are also peat, moor, and sandy soils. The fen soil is used almost exclusively for pastures, while the heavy clay is partly used for pasture (the lower part) and partly supports agriculture. Nearly everywhere in the sandy districts cattle, farming, and agriculture are practiced together. A large part of the sandy districts in the center and eastern sections is still uncultivated or is covered with woods. The arable lands consist of grass lands in the lower parts and cultivated lands on the higher ground. In South Limburg the soil is diluvial clay, and arable land is more in evidence than meadows but in North Limburg there are diluvial clay, sandy, and fen soils.

Much fertilizer is used, however, to maintain the fertility of the soil and in 1923 more than 1,298,000 tons (short) of commercial fertilizer were imported.

Climate—The moist and comparatively fresh climate is extremely well adapted to this branch of agriculture. The seasons are similar to those in the United States. In Friesland the cattle are driven to the meadows early in May and remain there until

the end of October or the beginning of November, according to the weather conditions and state of pastures. The cattle are then taken to the stables, where they remain for the whole winter, though often the young cattle remain outside until the middle of



The shaded portion of the map shows the part of the Netherlands which would be covered if the sea dikes were broken, and the dotted portion indicates the part lower than the rivers.

the winter to toughen them. The cool, damp air must be given a place as a valuable factor in this country aside from its favorableness for the growth of grass, as it is helpful in promoting the keeping of milk and its products.

Grass—Friesland is pre-eminently a district of pasture ground. More than two-thirds of the province is taken up by meadows. A Friesland farm generally has one-third for grazing and two-thirds are mown for hay.

In 1916 in the Netherlands 36.6 per cent of the whole country

was in grass. There has been no considerable change in the acreage of grass since 1833, the first official figures obtainable; that is, the meadows were and are about one-third of the total area of the land. In the neighborhood of large towns some changes have been made tending toward gardening. This is especially true in South and North Holland, but elsewhere the change is negligible. The best pastures in Friesland will support 25 milk cows and 29 head of young cattle on from 75 to 85 acres. After the first cut over the fields are then used for grazing. The grass season is a little longer in North Holland on account of the location between the Zuyder Zee and the ocean. At the present time the acreage of grass-land in Limburg is being increased.

Location—The Netherlands is well located for supplying dairy products to the principal manufacturing countries of Europe. Great Britain is just across the English Channel and furnishes a market for more than one-half of the butter and cheese on international trade. Germany and Belgium border on the east and south and France is a near neighbor. Fresh dairy products can be placed on each of these markets overnight and at a small cost for transportation. There are also excellent water connections between the Netherlands and the principal markets of Europe, while ocean steamers connect the principal ports of export with the ports of all other countries of the world and the Dutch have been noted for centuries as seafaring people.

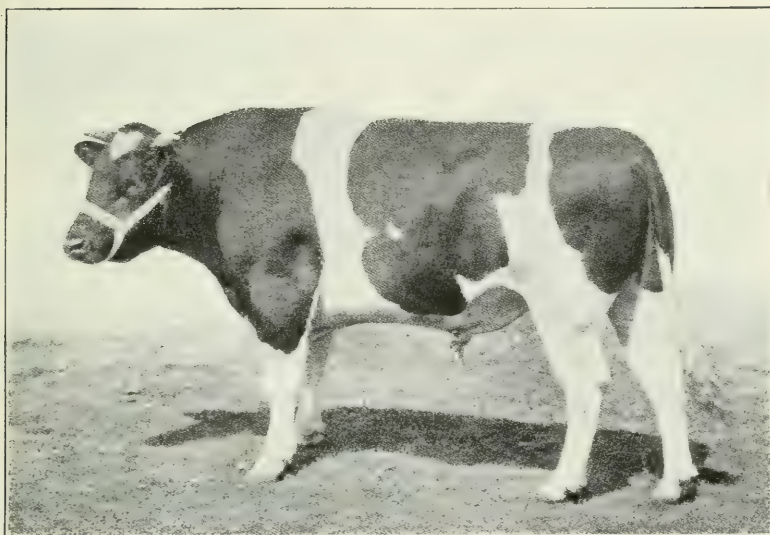
Cattle—*ORIGIN*—In very ancient times, according to Morse¹, "the people along the continental side of the English Channel had cattle. As early as 300 B. C. the Friesians dwelt along the shores of the North Sea. They were a peaceable, pastoral people. Little is known of their cattle but it is certain that a portion of them were white and that they were held in some religious significance. About the year 100 B. C. the Batavians, bringing with them black cattle, settled near the Friesians and since that time cattle keeping has been the chief occupation of that section."

"Since time out of mind," says Blink², "cattle raising has been carried on in Friesland and on a large scale." Before and during the Middle Ages Friesland carried on an extensive export trade in cattle and dairy products.

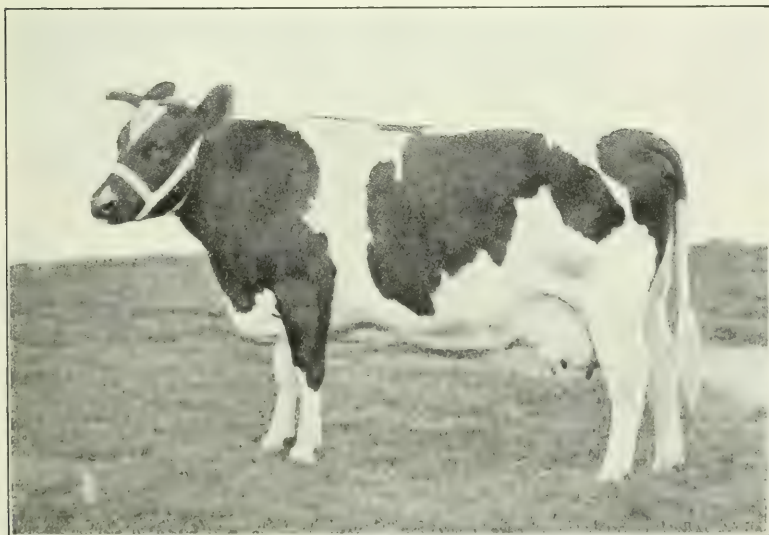
BREEDS—It is a common belief that the Netherlands has

¹ The Ancestry of Cattle by E. W. Morse.

² A General View of The Netherlands Trade by N. H. Blink.



Napoleon, No. 233 N. R. S., Black and White Breed.



Roza, No. 14350 N. R. S., Black and White Breed.

but one breed of dairy cattle, the black and white. There are, in fact, several breeds, three prominent breeds and two or three lesser breeds and many mixed breeds. The three principal breeds are: 1. Friesian, black and white, 2. Groningen, 3. Rhine-Meuse-Yssel. The Lakevelder or Dutch-belted forms one of the lesser breeds, and the red and white, similar to the Friesian, also have a number of herds.

LOCATION OF BREEDS—The Black and White Friesian cattle are found in Friesland, North Holland, South Holland, and Zeeland. The Groningen breed is found principally in the province of Groningen. The Rhine-Meuse-Yssel breed is found in the province of Overijssel and eastern and southern provinces, in Limburg and along the Rhine river. The mixing of breeds is found principally in Drenthe, Overijssel, Gelderland, and Utrecht, that is to say, bordering Germany and Belgium, but herds of Friesian may also be found in these provinces.

FRIESIAN CATTLE (Black and White)—This breed of cattle is one of the oldest and most noted, as well as possibly the most scattered breed in the world. The Friesian cattle have remained in the same territory, without new blood, for at least 2,000 years,¹ and have been famous for dairy purposes during the entire period. United States Consul Thos. Wilson, (1887) says:

"They (the Black and White) have an ancestry many centuries old, from which and through which, they have had a pure and unbroken descent; breeding in and in, without admixture or deterioration, preserving and perpetuating the characteristics and distinguishing marks of their race with a great certainty, definiteness and exclusiveness as the best blood known."

In size the Friesian cattle are one of the largest of dairy breeds. The females when not in milk take on flesh rapidly and soon become full in form. The cows range in weight from 1,000 to 1,500 pounds. The bulls at maturity are very large and heavy, many weighing as much as 2,500 pounds. In temperament the animals are quiet and docile; however, bulls of this breed are not different from others and may become dangerous when they get old.

MILK YIELD—The Friesian breed has long been renowned for its large milk yield. An official statement in 1920, based upon

¹The Ancestry of Domestic Cattle by E. W. Morse.

many statistics, gives the yield of a full-grown, pedigree cow for every lactation period (maximum 330 days) as 10,450 pounds of milk containing 3.30 per cent fat. This is only an average, as there are many herds in Friesland with a productive capacity of 22,046 pounds with 4 or more per cent of fat.

GRONINGEN BREED (White head)—The Groningen cattle, although less known than the Black and White cattle, have very good qualities. The breed is very striking in appearance with the white head and black body. A few specimens are found with red bodies instead of black. These cattle are more nearly in form and have greater fleshiness than the other two principal breeds. They are of medium size, being smaller than the Black and White cattle of Friesland. The average yield of milk is from 7,700 to 8,800 pounds yearly for full-grown cows. The breed has not been developed nearly so much as the Friesian cattle and while it is spoken of very highly still its possibilities as a dairy breed have not yet been clearly determined.

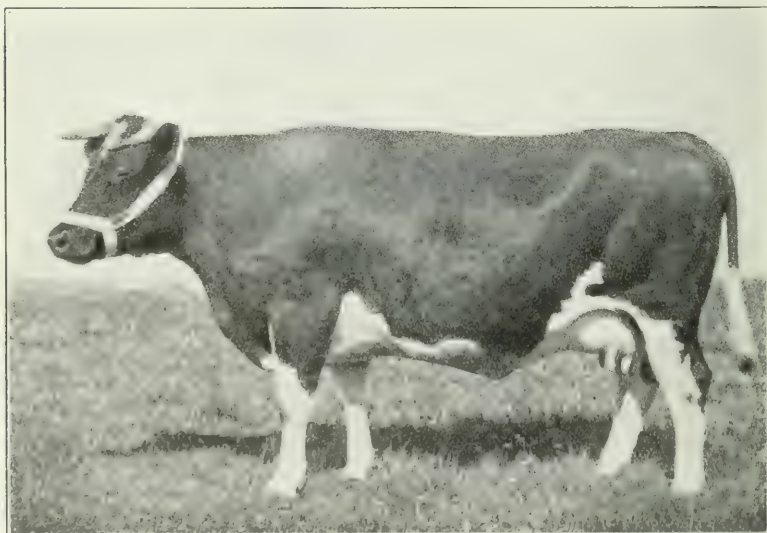
RHINE-MEUSE-YSSEL BREED (Red and White)—The red and white cattle of the eastern and southern districts of the country as well as along the rivers, have been classed as the Rhine-Meuse-Yssel breed. The purest specimen of this type is found in the Yssel district and in Limburg. This breed is more allied to the Groningen cattle than to the Black and White of Friesland. The animals are broad and short legged. The best of the breed are suited for either milk or meat. The preferred colorings are "Brownish red with chestnut head, body of lighter shade." In the province of Overijssel the average yield of milk in 1912 was 8,159 pounds a year, and in Gelderland it was 9,156 pounds of milk with a fat content of 3.22 per cent.

DUTCH BELTED BREED OR LAKEVELDER (Cattle with the white sheet)—This breed of cattle is very attractive in appearance, being black with a very large girdle of white around the middle of the body. There are some very fine herds in the neighborhood of The Hague. Some of these cattle were exported to America at an early date and it is probable that there are now more of this breed in America than in the Netherlands.

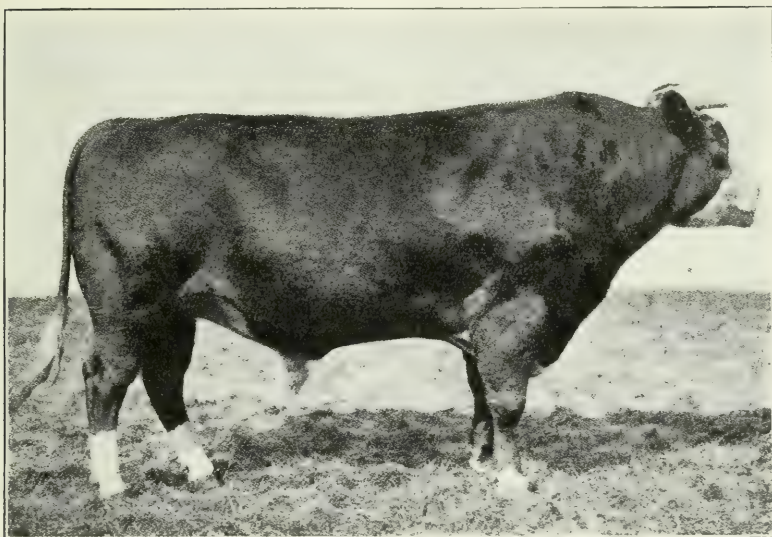
DEVELOPMENT OF THE DAIRY BREEDS The excellence



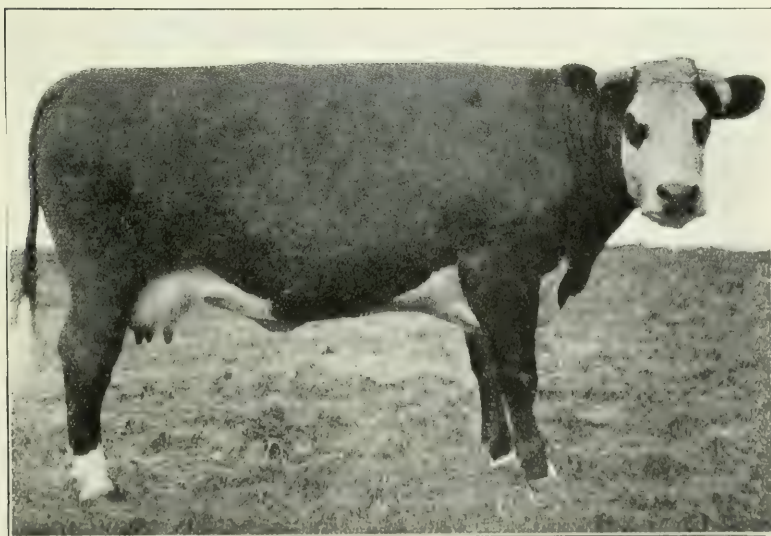
**Frits, No. 149 H. R. S. (as 2-year-old).
Red and White Meuse, Rhine and Yssel Breed.**



Bertha, No. 3380 N. R. S. (Dry), Red and White Meuse, Rhine & Yssel Breed.



Bram, No. 132 N. R. S., Groningen Black White-head Breed.



Lize, No. 391 N. R. S. (Dry), Groningen Black White-head Breed.

of the Netherlands cattle, especially the Black and White, is universally admitted, but as the history of the descent of these cattle lies for the most part in obscurity, it is uncertain which factors are most responsible for the present high standard of the breed. It is said that much is due to the climate of the country and its fine meadows, to special breeds belonging to older times, and to the systematic choice of breeding stock. While it is possible that all these worked together, the past history does not measure the credits of the factors mentioned, but the system of breeding in the last 50 years has played an important part in the present development of the breeds, and great improvement has been made. For example, in 1900 the average yield of butterfat in Friesland was about 3.00 per cent; however, the development along this line has been such that in 1924 the average was 3.40 per cent. Much emphasis is placed on form in connection with yield of milk.

A definiteness of purpose of breeders is thought to have an effect in the improvement of the dairy cows and the following quotation shows the purpose of the dairy farmers of the Netherlands:

"The Friesland farmer has for his aim in rearing a cow, which being fed and treated normally, regularly produces a good quantity of milk and butterfat for years; which is handsome, healthy, and of strong build, and when slaughtered yields meat which is not too fat but of excellent quality." (Blink.)

As late as 1880 about six breeds and 3 of 4 crossed breeds were claimed in the Netherlands as follows: Groningen, Friesian, North Holland, Flemish, Zeeland, Geldrian, and Drentish. Greater distinction among breeds now exists and the three principal breeds are clearly defined. The number of cows to the total number of cattle was as follows from 1871 to the present. 1871—63 per cent, 1900—58 per cent, and 1917—54 per cent and 1921—52 per cent.

HERDBOOK ASSOCIATIONS — The organization of the Friesian Herdbook Association (Friesch Rundvee Stamboek) in 1879 was the beginning of one of the greatest scientific methods for the improvement of cattle. The beginning of this register caused a series of measures to be taken having for their object to discover those animals of the greatest value for breeding purposes, and register them. Cows are judged for the herdbook when they have reached the age of two years and 10 months and have calved

once. Bulls are judged when 13 months old. Careful examination is made by competent judges of the outward appearance of all animals judged for register.

The herdbook association also keeps a careful record for pedigree purposes, as certificates of service and birth must be filed with the association within certain prescribed limits of time. This association also keeps records for certified inspectors and samplers of the milk production and butterfat of the entire lactation period of pedigree cows.

The sanitary service which began in 1870 had, in 1920, 14 veterinarians with 160 subordinates. These officials examined the herds regularly for disease. All activities of this service are recorded in the herdbook association and are open to the public.

All the cattle of Friesland are purebred but only 11 to 12 per cent are registered in the herdbooks.

The principal herdbooks are: (1) Netherland Cattle Herdbook, established in 1874, and reorganized in 1906. Its work covers the three breeds and extends over all the country except Friesland. (2) The Friesland Cattle Herdbook, established in 1879 and covers all the Black and White cattle of Friesland. (3) The Groningen Cattle Herdbook (established in 1908) and the North Holland Herdbooks affect only the cattle of each of these provinces.

In connection with these herdbook associations there are local societies of three kinds:

1. *Bull Societies*—These societies are to be found in all parts of the country and are advantageous in three ways. They encourage the keeping of high-producing cows, minimize the expense of keeping good bulls, and prevent the exportation of specially high-class bulls. There were in 1924 519 bull societies.

2. *Control Societies*—These societies make and keep the records of the cows of the members. The records cover quantity of milk and butterfat produced. The first society was founded in 1896 and in 1924 there were 553 societies.

3. *Breeding Societies*—These organizations generally exercise the function of both the other societies and also keep records of breeding and young stock. There were in 1914 200 breeding societies.

There is not the same density of dairy cattle in all the provinces of the Netherlands. The land not being equally adapted to dairying and the economy of other agricultural pursuits are the principal cause of these variations.

The Number of Dairy Cattle in the Netherlands and the density per 100 hectares (247 acres) by provinces, for 1910, and the total cattle for 1921

	Total Cattle	Cattle per 100 Hectares of Land	Total Cattle
	1910	1910	1921
Groningen.....	106,655	55	98,621
Friesland.....	306,574	114	331,089
Drenthe.....	96,197	60	102,555
Overijssel.....	180,781	92	202,849
Gelderland.....	283,278	97	301,094
Utrecht.....	131,083	138	130,417
North Holland.....	204,532	103	193,206
South Holland.....	302,813	127	296,918
Zeeland.....	83,800	57	69,850
North Brabant.....	225,932	80	222,660
Limburg.....	105,297	81	102,452

NUMBER OF DAIRY COWS AND TOTAL CATTLE
(Jaarcijfers Kroninkrijk der Nederlanden, Rijk in Europe)

Year	Dairy Cows	Total Cattle	Year	Dairy Cows	Total Cattle
1851	.....	1,243,700	1910	1,068,361	2,026,943
1861	.....	1,335,300	1913	1,109,697	2,096,599
1871 ¹	911,200	1,435,700	1917	1,234,375	2,301,532
1881 ¹	893,900	1,434,400	1918	1,130,908	2,048,872
1891	897,400	1,532,200	1919	1,232,264	1,968,609
1900	965,800	1,655,600	1921	1,085,713	2,062,771

¹ For 1871 and 1881 the number is a 10 year average.

The record density of dairy cattle in the Netherlands is in the neighborhood of Gouda, where in 1910 there were on 100 hectares (247 acres) 206 head of cattle as well as 163 pigs and 45 poultry. For the whole country there is an average of one cow for each five persons.

CARE AND HANDLING OF DAIRY CATTLE—The cows generally calve between February and April. The bull calves, for the most part, and some of the heifer calves, are slaughtered while young. The calves which are saved are offered in the autumn on the market, or exported or slaughtered as "grass calves." Calves are usually fed a short time, 3 or 4 weeks, on full milk which is gradually replaced with buttermilk and skim milk to which meal is added. In autumn the calves are turned on the grass pastures.

The grazing begins about the first of May and the cattle are taken off the pasture about the last of October, according to the season and condition of the grass. Once the cattle are indoors they remain all the winter. Cows are usually dry for the last 2 months before freshening.

Men and women look after the cattle and milk the cows twice daily whether on pasture or in stalls. In fact the farmer and his family live with their cattle and groom them a great deal. The following quotation from Houghton gives a clear view of the home life of the average farmer and his family and indicates the round of work of the year:

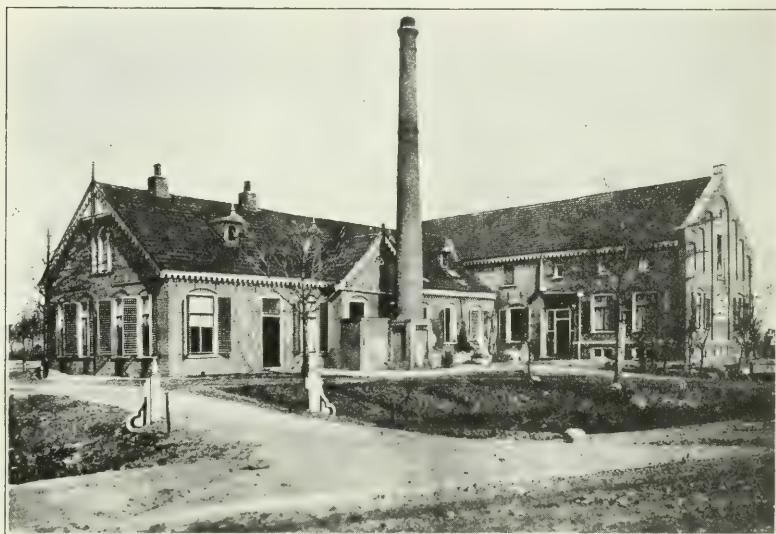
"Their farmhouses are fashioned after a general model; the one immense roof covers everything that requires protection. Here the cattle find shelter through the rigorous winter months. Here they are fed and groomed and watched for months without being turned from the door. Here the family is also sheltered sometimes with only a single partition between the cattle stall and the kitchen and living room. Everything is kept with a degree of neatness marvelous to those not accustomed to such a system. The cattle become the pets of the household. At the opening of spring or when the grass comes about the first of May they are taken to the fields and cared for in the most quiet manner. Canvas covers protect their bodies from the sun and storms and insects. On the first appearance of winter they are returned to the stables and the simple round of the year is completed. This round is repeated until the cattle are 6 or 7 years of age when they are usually considered past the period of dairy profit and are sent to the shambles (butcher). The object is to always produce as much milk and beef from the same animal as possible. With the twofold object in view selection, breeding and feeding have been continued for ages."

A regular clearing of the herd takes place every year. A good breeding animal is kept as long as possible but a young cow that does not come up to the requirements of the cow-testing association is promptly slaughtered. This clearing of cattle causes a continuous movement of cattle from the North to the South.

FACTORY SYSTEM—The factory system which started in America about 1860 does not appear to have obtained much of a foothold in the Netherlands until after 1877, when the first two butter factories were established in Friesland. The first cheese factories date from the same year, while the first cooperative factory began to operate about 10 years later, 1886.

About the year 1880 dairying took on new life. The hand churn on the farm gave way to the factory, with churns run by steam. This removed much work from the farm and thereby per-

mitted the greater expansion of dairying without additional farm labor. The cream separator was introduced and used in factories but not on farms. The chief dairy products of the Netherlands



Cooperative Dairy Products Factory at Gerkesklooster, Netherlands.

are butter, cheese, and condensed milk, and the factory system owes its origin and development to the extent to which it has been able to improve the quality and increase the production of these products. The change to the factory system was rapid in the case of butter. In 1900 half of the butter was produced in the factories and in 1912 there were 75 per cent produced in factories, while in 1920 only 10 per cent was produced on farms. The change for cheesemaking from farm to factory was much slower; in fact, most of the full-cream Gouda cheese is still made on farms and, it is claimed, with economy.

A number of kinds of factories have sprung up in the industry. There are steam butter factories and cheese factories, and hand butter factories and cheese factories, part of which are cooperatively owned and part individually owned. Some of the factories manufacture either butter or cheese and some add to these two products many kinds of by-products.

At the present time the factories are constructed with a view to

long service and therefore the buildings are expensive and well planned. The machinery and other equipment are also of the best. Nothing in the country speaks so much for the permanence and dependence upon the dairy industry as do the factories themselves.

COOPERATIVE ORGANIZATIONS—It is difficult to establish the position or importance of cooperative organizations in the Netherlands. They grew up soon after the factory system was firmly established (1885). The independent factories were meeting strong foreign competition and some of the traders in butter in the Netherlands had begun to adulterate exports of butter. This caused a decrease in the price of butter especially on the London market. The fraudulent traders were strong and it took years to defeat them and reestablish the good name of Dutch butter. While this was being done the Danish obtained the lead on the best market. The competition of America's cheap feeds and fat cattle lessened the profits on European fat cattle and made it necessary for the Netherlands as well as Denmark to depend more and more on dairying. In fact, it is called the crisis of 1880. Cooperative factories were built and operated against these difficulties. The idea soon developed that the necessary grains and fodders imported could be bought more cheaply by cooperative organizations. This proved to be true and the next step was the founding of selling cooperative organization.

The cooperative butter and cheese factories organized provincial unions which together formed a federation. The independent or proprietary factories were also organized. Both of these organizations were recognized by the government, which gave them every possible encouragement. The first cooperative creamery was founded at Warga, Friesland, in 1886.

The General Netherlands Dairy Union ("F. N. Z") was organized in 1900 at Utrecht as a federation of provincial cooperative unions. This organization has six objects and activities: 1. By collaborating with all who can aid in the prosperity of the unions. 2. By discovering and prosecuting fraud in the manufacture or trade of butter in dairy produce. 3. By pressing authorities to adopt all measures advocating the interests of the industry. 4. By granting diplomas for certain work in the industry. 5. By drawing up statistics on dairy products. 6. By

issuing a bulletin and other publications regarding the manufacture of dairy products.

Other activities in cooperation were the cow-testing associations, bull societies, and each of these activities is being followed



Map Showing the Distribution of Cooperative and Non-Cooperative Factories.

by a train of technical and scientific research which have been brought forward one at a time to remove difficulties which were in the way of progress. Once the cooperative movement began it

has continued and is now a real network over the whole country. The country is not only covered but each member of the cooperative belongs to several societies and there is an overlapping of societies but a unity of work.

It must not be assumed that there are no privately owned factories, as both cooperative and independent, or privately owned, factories are inter-mixed all over the country. The organization of the latter was effected in 1908: The Union for Dairy Industry and Milk Hygiene. The purpose is: Promoting the interests of the Dutch dairy industry and milk hygiene in the broadest sense of the word.

The Friesian Cooperative Society for exportation of milk products was founded at Leeuwarden in 1898 by 6 dairy societies and in 28 years has developed to an enormous enterprise. The principal reasons for success were economical, technical, and commercial. The number of societies has risen to 39. The quantity of milk handled through this organization in 1924-25 was 530,000,000 pounds, from which was made 12,000,000 pounds of butter and 35,000,000 pounds of cheese. In the General Netherlands Dairy Union (F. N. Z.) are organized 435 plants, January 1, 1925, and the average amount of milk handled a year ago was 3,250,000 pounds.

The total number of cooperative plants manufacturing dairy products was 617 in 1925, and the number of individually owned plants was 314.

GENERAL DEVELOPMENT OF DAIRYING—The development of dairying in the Netherlands has had so far-reaching an effect on the dairying of other countries that it is hard to over-estimate its importance. The development in that country is also important as it appears to have the principal factors of man, and nature, and suitability to the industry, such as rich soil, luxuriant pastures, a cool, moist climate, easy access to the ocean, excellent breeds of dairy cattle, and an industrious, pastoral people. "Perhaps a factor equal to any other, is the equanimity of those who work with their hands—and these represent about 75 per cent." (Whyte)¹ The size of the farms (about 30 acres) is a factor making possible concentrated production of milk alike advantageous for factory development and collective marketing of the factory products.

¹ Dairying in Netherlands, R. A. Whyte, Agr. and Tech. Inst., Ireland.

With these favorable factors it has been possible to achieve a really wonderful development in dairying. The progress, however, has been neither regular nor rapid. Economy and necessity seem to have guided from the first. Just when and how the dairy industry began and how it was expanded over the whole country is not known. The earliest details of dairying revealed an industry covering the production of milk in great quantities, of butter and cheese of such quality that little improvement is claimed even in recent years. The butter and cheese were made in the homes and principally by women. The variation in the quality of the cheese from different farms was comparatively small. The industry, however, after having reached this stage of development seemed to stop for a number of years just prior to the introduction of the factory system.

The stability of dairying in the Netherlands is largely due to the manner of development. Most of the decisive steps leading to definite reforms came from the people themselves, i. e., from below and not from above. This is one of the most encouraging features in the Netherlands' dairy progress. It means that changes are made only when they become necessary to the proper operation of the industry. Such changes must, therefore, be close to the equitable needs of business practices.

EARLY TROUBLES—About the time the factory system began to get a foothold, (1877) and skim-milk utilization, therefore, became a problem, many cheesemakers began to use skim milk in the manufacture of Gouda cheese, which had always been made of whole milk. The lack of the proper amount of fat in the cheese seriously hurt its quality and soon the reputation of the cheese industry was threatened. The danger was quickly realized and laws passed which protected the good name of the Gouda and Edam cheese and also guaranteed the fat content to the buyer. Gouda and Edam cheese are now made with 20, 30, and 40 per cent fat in the dry matter as well as whole milk which must be marked on the outside of the cheese. Another result of this experience was the establishment of cheese control stations in 1907.

As early as 1870 efforts began to be made to adulterate the butter of the southern provinces by mixing margarine or fats with the butter. This continued until the honest traders and the

farmers, in a hard struggle which ended in the "two-years' butter war" (1904-05), overthrew the syndicate of defrauders. This defective butter was sent to the London market, causing a much lower price for all Netherlands butter up to the year 1911, when it again reached the same price level as the Danish butter. The loss due to the low price for butter during this period was enormous.

BUTTER LAWS—A butter law was enacted in 1900 to prevent the adulteration of butter, but as it was not effective it was amended in 1905 and a new law was passed in 1910. This law entirely separated the manufacture and handling of margarine from butter, and established a 10 per cent maximum of butterfat in margarine and a minimum of 80 per cent butterfat and a maximum of 16 per cent of water in butter. Since 1902 butter has further been distinguished from margarine by a government mark. This government mark may be used only by the members of control stations under permission of the government. The first control stations were established in South Holland and Friesland in 1921. The inspections are made by traveling inspectors, who take samples of the butter of its members, either on farm, in factories, or in transit. Any fraud is punished and all products of members must be officially marked. The use of the official mark is denied members who violate rules.

Since 1913 the government has permitted the marking of full milk cheese. This mark is not compulsory but control factories must mark their products. Marks for the skimmed cheese were established in 1921.

In 1924 the butter under control amounted to 140 million pounds, practically all of which was made in factories. The per cent under control is gaining each year. The staff of inspectors in 1921 comprised more than 40 experts connected with 8 stations.

MANAGEMENT — The creameries are managed by well trained men. If a man can work up to the position of creamery manager in 5 years he is considered fortunate. The assistant managers are men, generally younger, who are working toward the position of manager and taking the necessary practice. However, some 20 years ago the industry recognized that all efforts to improve the management and equipment of creameries would be futile unless milk producers observed their duty in handling the

milk. The dairymen took this self-imposed law and put it into practice, i. e., the law of cleanliness, to produce clean milk, and deliver it sweet twice a day. The law of cleanliness is now a habit.

Through and above these personal factors is the good will and sympathy of individuals and organizations to one another and to the government agencies of the industry. There are cheese and butter factories side by side and home dairying is also carried on profitably in the same districts. Some factories are cooperative and some are independent or proprietary but each operates throughout the same localities with seeming success and friendship.

EXTENSION AND MAGNITUDE OF THE INDUSTRY — The details of the extension of dairying over the Netherlands are not known; however, the distribution was quite general at the time of our earliest reliable information. Having been engaged in dairying for a thousand years, it is not surprising to find an extensive trade in the 16th century, and in 1833, date of first records, the pastures covered practically one-third of the land. The extension of grass land must have been fairly complete, as the area of pasture land has continued in about the same proportion up to the present.

Butter and cheese were made on farms until about 1877, when factory production began. The change from farm to factory was slow, especially in the case of cheese, as practically one-third of the cheese is still made on the farms. In general, the greatest number of cattle and the highest development of dairying follows the more fertile soils of the country.

FRIESLAND—In Friesland, which is comparatively thinly populated, the principal occupation is dairy farming and cattle breeding, while agriculture and the fattening of cattle are secondary. Butter and cheese (Gouda, Edam, Cheddar, and Cheshire) are made in factories. Condensed milk is also made in large quantities. Some of the factories are equipped to make all kinds of dairy products and by-products. The factories receive whole milk twice daily.

GRONINGEN — This province is principally agricultural. Cattle breeding and dairying are secondary. Many cows are sold annually from this province to South Holland. The fattening of young cattle is prominent. Butter and cheese are made as well as condensed milk but butter is the chief product.

NORTH HOLLAND—The land in this province is very low. It has a mild climate, excellent pasture lands, and a fertile soil. Gardening and crop farming are of more importance than in other parts of the Netherlands on account of the large cities and denser population. This greater population also requires a larger part of the milk for consumption. The calves are generally slaughtered and many of the cows are bought from other provinces. Cattle fattening is important. This is the home of the Edam cheese, which is made about one-half on farms and one-half in factories.

SOUTH HOLLAND—This province has large cities and dense population. Large distilleries furnish an immense amount of brewers' grain for cattle feed. This is the principal province for the production of condensed milk. The large margarine factories are in this province and require great quantities of milk. Gouda cheese is made on farms and is generally coupled with pig fattening. The fattening of cattle is also of importance. Thus it will be seen that there is need for a large number of cattle in this province and it is second to Utrecht in numbers of cattle. Dairy products include Leyden cheese and whey butter.

ZEELAND—Dairy development has been backward in this province but in the last few years it has been receiving more attention. The Black and White breed of cattle is displacing the original Flemish breed. The breeding of heavy horses and tillage or gardening is giving way to dairying. Fattening young cattle is still important.

NORTH BRABANT—North Brabant is the intermediary for the stream of cattle which are culled from the dairy herds of the north and move south all the time. The cattle of this province are mixed breeds and the calves are usually fattened for sale in Belgium.

LIMBURG—Dairying and the grass lands are increasing, although gardening is important. Fruit farming is also carried on.

UTRECHT—Utrecht is considered the least progressive of the provinces. Its cattle are of a mixed character, grades as well as purebred cattle. Gouda cheese is made mostly on farms. Butter is made about half in factories and half on farms. Breeding and fattening are of secondary importance.

GELDERLAND—Only a small portion of this province is suited to dairying while the cattle are of mixed breeds and fattening is largely practiced.

OVERYSSEL AND DRENTHE—While the soil of these provinces is not the best, they have made considerable progress in cattle and pig farming in recent years. Not much agricultural products is marketed. The cattle are of mixed breeds, although the red-and-white (Rhine-Meuse-Yssel) breed has fine herds near Deventer and Zwolle, while the Black and White (Friesian) cattle are found in the northern part of Overijssel. The principal dairy product is factory butter, although some farm butter is made in



Edam Cheese Market in Holland.

both provinces. Factory cheese is made in Overijssel on a small scale and some farm cheese; in Drenthe cheese is an even less important product.

In the whole of the Netherlands the factory system is pushing the farm-manufactured products out rapidly, with the exception of Gouda and Edam cheese, which are still made largely on farms. The establishment of factories for the manufacture of all kinds of dairy products is being encouraged and those now in operation are giving good results, as they can turn from one product to an-

other and thus avoid overproduction of any one product. The factory system gives more opportunity for organization within the provinces and the combining of these organizations into general unions which cover the entire country. The work of the herdbook association is being felt in all parts of the country, causing the pure breeds to receive more and more attention. All these activities are being fostered by the government, which is ready to assist any advance in the dairy industry. Since the year 1910 there has been still greater development than previously in cooperative organizations and factory development. The total production of butter in the Netherlands has been increased until in 1924 it amounted to 161,584,000 pounds, and cheese production was 243,641,000 pounds. In 1923 more than 200,000,000 pounds of condensed milk, sweetened and unsweetened, were made.

MARKETS AND MARKETING—The dairy products of the Netherlands have found their markets in all parts of the world and in all the usual methods. The surplus which was exported during the 19th century was taken principally by Great Britain up to the year 1880, when the exports of butter to that country began to decrease and Danish butter took its place the Netherlands butter being diverted to other markets—first to Germany, Belgium, etc. The Netherlands butter trade with Great Britain was never fully recovered.

During the period just prior to the introduction of factories there were many domestic markets for butter which were operated weekly. The principal ones were at Zwolle, Kampen, Meppel, Raalte, Deventer, Leyden, Delft, and Leeuwarden. The principal markets for cheese were and are at this moment: Gouda, Bodegraven, Alkmaar, Hoorn, and Leeuwarden.

When the competition from Denmark affected the sale of Dutch butter so seriously on the English market, and a general fall in prices of agricultural products together with keen competition abroad, especially from America, and this effect began to be felt, it appears that cooperative action became interesting and within a short time cooperation was pretty well established.

In 1898 the Friesian cooperative dairy export association was organized at Leeuwarden to sell all the butter manufactured by its members. Since 1914 this association also sells all the cheese produced by its members. Cooperative factories in other parts of

the country also formed export associations, some of which have not succeeded very well and disappeared after a few years.

All the butter which is exported from the Netherlands is controlled by the controlled stations and marked: "NETHERLANDS BUTTER CONTROL UNDER STATE SUPERVISION." This superscription surrounds the coat of arms.

The control butter in 1924 amounted to more than 140 million pounds and the control cheese amounts to 215 million pounds, while the condensed milk, sweetened and unsweetened, amount to 160 million pounds and milk powder 25 million pounds. In 1920 practically two-fifths of the control butter was exported. In 1924 about one-half—of the total butter manufactured was exported, three-fourths of the cheese and practically all the condensed milk. The difference between the exported quantities and the amounts manufactured are marketed for domestic consumption.

All butter must contain at least 80 per cent of butterfat, and may not exceed 16 per cent of water.

The marketing of farm butter and cheese had a small beginning and was for years largely barter, not only for provisions but for textiles, grain for the cattle and even commercial manures in some sections. It required continuous efforts from the government and the farmers to do away with this method of marketing in which the farmers were tied to the local markets.

PACKAGES—Factory butter is generally packed in beechwood tubs of 50 or 25 kilograms' capacity (110 or 55 pounds). The "Dutch rolls" quoted on the London market are packed by factories especially for that market. Butter sold on Maastricht are sometimes packed in baskets with fresh straw. This market also sells butter in 50 and 25 killogram tubs. Butter which is packed for the tropics is put up in tins of 1, 2, and 5 or more kilograms and is noted everywhere for its quality.

The production of butter in organized cooperative and independent concerns, which is the greater part of the total, is partly marketed through export organizations and partly exported by the factories themselves or through the intermediary of the merchants. The surplus of the farm butter is used in the large blending fac-

tories, mainly in Rotterdam. In a word, butter and cheese are largely disposed of either through large export organizations or to the local merchants.

A few of the marketing cities have what are called auctions. The cheese market at Alkmaar, as at other places, is conducted by the municipality. A charge is made of about one-quarter of a cent a pound for the facilities provided. A rather novel and more modern method of selling butter by auction is now in vogue in other places. One of the most important markets of this class has been in operation at Maastricht ever since 1895. Sellers bring their produce to the market and register it. The different lots are then auctioned in the following manner, as described by Ruddick:¹

"There is a large dial with a wide range of prices marked on the circumference. The pointer, which is operated by electricity, is set at the highest point, and when started slowly descends the scale. Each buyer has an electric button which he can operate unseen by his neighbors. When the pointer falls opposite the price which any buyer is willing to pay he presses the button, the pointer stops, and his number is indicated to the clerk and the sales recorded. The apparatus is arranged so that no two buyers can register at the same time and the identity of the buyer is not disclosed for the time being. Each lot of butter is handled in the same manner."

Auctions of the same kind are held weekly at Roosendaal, 'sHertogenbosch, Zutphen, and Leeuwarden.

MARGARINE—The process of making margarine was invented about the year 1870 and soon found its way into the Netherlands, where it has been manufactured in large quantities especially for export since that date. The raw materials which go to make up the product come largely from the United States or through concerns controlled by American capital. This industry is one of the most successful in the country at the present time and bids fair to continue its prosperity for several years at least.

Prior to the World War the principal export trade in margarine was with Great Britain and Germany. During the war these exports decreased for want of raw material and for lack of opportunity to ship the product out of the country. After the war these principal markets were largely supplied by home product from factories built and operated during the war. However, the export trade has increased much better than expected as Dutch margarine

¹ J. A. Ruddick, Ottawa, Canada, dairy and cold storage commissioner.

has a high standard of quality and in 1919 the exports were 118,-789,000 pounds and in 1920 they had increased to 202,565,000 pounds.

The government regulations for the manufacture of margarine are very rigid. The word "Margarine" must be posted wherever it is made, sold or stored. The butter law of 1910 had for its basis the complete separation of butter and margarine. All commodities similar to butter containing foreign fats must be classed as margarine, for storage, export, transportation, and sale.

EDUCATIONAL — The educational facilities have been developed and special courses on dairying have been added. The agricultural university and the dairy institute are at Wageningen, the state dairy school at Bolsward. The experimental and research work is carried on principally at the experimental dairy farm and the state agricultural experimental station at Hoorn.

Attention has already been called to the educational work of the control societies and the herdbook associations through lectures, short courses and personal instruction in factories.

GOAT KEEPING—While the keeping of goats in the Netherlands in recent years has achieved considerable importance it has not reached the importance that it has in some other countries. The goat is used for milk production for use in liquid form but not for manufacture of dairy products.

According to Francis' the "Goats in Holland are practically all kept by the poorer people, landworkers, rural workers of all types, and by the poorer dwellers in the smaller towns. Few of these people own more than one or two milk goats which are usually house fed, and are almost invariably kept to supply milk for the household and especially for the young children."

The Netherlands has a native breed of goats, which in the last 20 years has been bred up with imported Saanen and Toggenburgs until the goats now found in the country are mostly grades of the imported breeds of milk goats. These importations were for the purpose of developing the milk yield. While the importation of goats was a very important factor in the improvement of the milk goats, the forming of goat-breeding associations was also very important. The first association was organized in 1908 in

¹ Goat Keeping in Holland. The British Goat Society's Yearbook. Percy A. Francis.

North Brabant. These associations now cover the whole country. They provide breeding stock, encourage better methods of feeding and housing, and grant insurance against death of the animals.

The local associations are again united in provincial unions, which maintain goat-breeding centers. Some of the provincial unions have established herdbooks for their members. The provincial unions are united in a body known as "The Netherlands commission on goat breeding," which is really a committee from the provincial unions. The number of associations was 424 in 1920. The number of goats in the whole country was in 1900 224,231 and in 1921 272,000.

MILK SHEEP—Purebred, registered, milk sheep are another part of the Netherlands' dairy industry. Friesland has a herdbook for milk sheep. The Friesland milk sheep are bred for the production of milk, although the wool is moderately long and of good quality. These sheep are milked from April to December. The daily yield per ewe is from 0.2 to 4.4 pounds of milk with a fat content of 5 to 10 per cent. The milk is used for the making of cheese on the isle of Texel.

CHRONOLOGICAL EVENTS

YEAR

- 300 B. C. Friesians dwelt on shores of North Sea.
- 100 B. C. Batavians settled near the Friesians, bringing black cattle.
- 660 A. D. There was a cattle market in Utrecht.
- Middle Ages Friesians had export trade in cattle and dairy products.
- 1266 Cattle market at Haarlem.
- 1365 Butter and cheese market in Gouda.
- 1618 An ox in Hoorn weighed 2,100 pounds.
- 1697 Produced 3,460,964 pounds of Gouda cheese.
- 1713 Rinderpest came into the Netherlands.
- 1714 Rinderpest in Friesland and Groningen, 52,858 cattle died.
- 1744-56 Rinderpest epidemic, 109,597 cattle died.
- 1766 Rinderpest epidemic for six months, 97,756 cattle died.
- 1766-1800 Rinderpest epidemic through the period, 261,028 cattle died.
- 1801 North Holland marketed 17,894,427 pounds of cheese.
- 1804 North Holland marketed 18,472,544 pounds of cheese.
- 1865-67 Rinderpest epidemic again.
- 1870 Effort to adulterate Dutch butter began.
- 1870 Sanitary service began.
- 1874 Netherlands cattle herdbook society organized. Principally the work of H. F. Bultman and J. P. Amersfoordt.
- 1877 Factory system started; two factories built.
- 1879 Friesian herdbook association organized.
- 1880 Dairying took on new life—cream separator introduced, 800 head of cattle exported to America (Friesian).
- 1880 The crisis—Competition from America on grains caused greater dependence on dairying.
- 1886 First co-operative creamery built.
- 1896 First cow-testing association formed.
- 1898 Friesian co-operative society formed for export dairy products at Leeuwarden.
- 1900 Average yield of butterfat for Friesland was 3 per cent.
- 1900 Organization of the Netherlands Dairy Products Union (F.N.Z.).
- 1900 Butter law enacted to prevent adulteration.
- 1902 Control stations established for inspection of butter.
- 1904-5 Holland butter law passed, to prevent adulteration of butter.
- 1908 Independent manufacturers founded a federated association.
- 1908 The first goat association was organized in North Brabant.
- 1910 Law passed entirely separating the manufacture and handling of butter and margarine.
- 1924 The average butterfat yield for Friesland was 3.40 per cent.

PRODUCTION OF DAIRY PRODUCTS
(Netherland Yearbook)
(Thousand Pounds—000 Omitted)

Year	Butter	Cheese	Condensed Milk		Milk Powder	Skim Milk Powder
			Whole	Skim		
1903	131,491	154,889	.....	.....	.....	.....
1906	132,424	174,318	.....	.....	.....	.....
1910	142,430	185,125	.....	.....	.....	.....
1912	148,167	211,002	.....	.....	.....	.....
1919	.....	132,276	11,241	23,590	1,914	8,823
1920	.....	179,816	36,738	77,910	5,708	7,649
1921	132,483	215,403	50,618	112,059	9,722	3,007
1922	142,490	215,215	40,049	146,624	6,975	3,710
1923	153,037	232,682	.....	.....	.....	.....
1924 ¹	161,584	243,641	.....	.....	.....	.....

¹ Preliminary.

IMPORTS AND EXPORTS OF BUTTER AND CHEESE
(Statistiek van den in-uit-en doorvoer)
(Thousand Pounds—000 Omitted)

Year	Butter		Cheese	
	Imports	Exports	Imports	Exports
1850	232	26,491	287	49,184
1860	1,572	39,331	612	61,021
1870	6,861	47,865 ¹	512	64,446
1880	2,760	79,480 ¹	635	61,857
1890	8,835	87,203	655	66,832
1900	1,634	49,763	579	101,209
1910	4,492	72,456	677	122,771
1918	43	5,415	1	32,893
1920	131	45,576	489	99,738
1921	4,401	44,529	802	115,279
1922	10,816	50,981	750	143,769
1923	1,687	52,769	873	136,646
1924	3,613	76,570	888	170,352

¹ For the years 1870 and 1880 Oleomargarine was reported with butter.

IMPORTS AND EXPORTS OF CONDENSED AND POWDERED MILK
(Statistiek van den in-uit-en doorvoer)
(Thousand Pounds—000 Omitted)

Year	Condensed Milk		Milk Powder	
	Imports	Exports	Imports	Exports
1917	1	116,277	.....	9,474
1918	42	44,253	.....	3,761
1919	98	35,541	.....	10,736
1920	75	115,804	79	13,358
1921	281	166,899	1,509	12,729
1922	534	190,581	1,096	10,686
1923	163	227,393	1,056	13,889
1924	236	233,901	1,931	21,149

FRANCE

"In France, without our machinery, our appliances, our energy, or our cattle, the best of butter and cheese is made and largely consumed by a people who are especially connoisseurs of both."—Long (England).

NATURAL CONDITIONS—France has a mild climate, abundant rainfall, large, natural meadows, excellent pasture, and a peasantry well suited to dairying. The mean temperature is 55° F. and the extremes are not great. The rainfall is varied—in Paris it averages about 23 inches, in the Alps and Pyrenees it is as much as 45 inches, while along the Atlantic coast it is only 33 inches.

The natural meadows of Brittany, Normandy, and in the mountains are rather extensive, and in 1922 covered more than 12½ million acres, while there were also 9.9 million acres of pasture, 2.6 million acres of alfalfa, in clover 2.6 million acres, and in sainfoin 1.5 million acres, making nearly 30 million acres of grassland in all. To this should be added 2.2 million acres of fodder beets and cow cabbage. In grasslands there was a gain of about 10 per cent between 1875 and 1922.

Agriculture is very important in France, as more than 75 per cent of her population are employed in farming, livestock raising, and dairying.

ANCIENT HISTORY—It is impossible to make definite statements for the exact territory included in France as at present, as the boundaries have been changed continuously for centuries and it is only possible to give such data as are found for this section of Europe covering France in general and further no attempt has been made to enlarge upon the brief statements found for this early age.

During the earliest period for this section, for which there is record, extending back from 2,000 to 4,000 years, B. C., the country was inhabited and cattle, sheep, goats, swine, and perhaps the horse were domesticated and existed in northern and central

Europe (Morse, *The Ancestry of Domesticated Cattle*). The cattle were used as beasts of burden, the cows milked, and butter and cheese were made. About the year 1,500 A. D. cattle raising held an important place in central Europe. The cattle were smaller than the present cattle, possibly from inbreeding, it is said.

ANCIENT GAUL—Morse states that:

"In very ancient times, along the continental shores of the English Channel (northern France and the Netherlands) the people had cattle of the longifrons type. Further east the people living between the Danube and Alps possessed large and strong cattle that must have been of the primigenius type. The color of these cattle was red with white markings. We may consider this breed as the progenitors of the modern breed of Salers (France). In the meantime the original breed had been crossed with the *Bos Brachycephalus*, and the resulting cross was known as the "Celtic Red."

About the middle of the 4th century the Salic Franks entered Gaul and after much fighting settled in the northern part, bringing large cattle with them. Before the close of the next century the rest of Gaul was conquered, though but few cattle were introduced, according to Werner.

The dairy industry was little developed in the Gallo-Roman era. Cattle were used principally for labor and sheep for wool. However, there was some development in three types of cheeses as they are mentioned as being used in Gaul, Nimes, Lesura (Lozene), and Gabali (le Gevandan). Butter appears to have been little used and it was considered a medicine.

Cattle are seldom mentioned by historians and it is thought that it was possibly due to the poor pastures and therefore poor cattle. Charlemagne, however, is known to have encouraged the raising of cattle and the manufacture of butter and cheese. Large numbers of sheep and goats were in all parts of the country. There were some fine cattle in Normandy. These early cattle were not well developed. Charlemagne transformed the chieftains to feudal lords and introduced Christianity throughout his kingdom and thereby obtained the first rudiments of orderly government. During the reign of Louis VI (1108-1137) serfdom was abolished. The cattle remained undeveloped up to the 18th century.

One factor has had a lasting effect on the development of cattle in France, that is, the French eat much less meat than the English and thus their cattle have been developed for the dairy and for

draft purposes rather than for meat. This will be noted when the discussion of breeds is reached.

In the olden times the French peasants attached little importance to beef production and an animal was seldom sold to the butcher until it was more than 10 years old. In 1854 the government realized this tendency to neglect proper breeding of cattle and instituted annual shows where prizes were offered for the best specimen of cattle, of beef and dairy types.

EARLY RECORDS—In 1688 it was estimated that there were 50,000 head of cows in Flanders.

In 1789 two breeds of cattle were noted, namely, "Flamande," of red-brown color, and Maroillaise, also red-brown. In 1773 a disease, "epizootie," (foot-and-mouth disease) broke out and many animals died. The cows at that time gave 1½ livres (pounds) of butter per month. In 1787 some cattle of "very large size" were imported into Picardy from Flanders and Holland.

The Parthenaise breed was prominent at the end of the 18th century in Poitou and were noted for buttermaking, but other cattle were also numerous. The Parthenaise breed was developed in the middle of the 18th century.

In 1778 the Swiss cattle were introduced by M. de Rouge of Chelet, who brought in a number of bulls and cows from Fribourg, Switzerland. Other importations from Switzerland are recorded for the purpose of "regenerating" the cattle of France, according to the Enquete, 1902.

By the end of the 18th century the cattle had been developed in size and those called "Flandrines" were specially noted for their milk production.

Prior to the Revolution there were many cattle in France, pastures were extended and facilities for breeding were provided, but after the Revolution there appeared to be little interest in cattle raising.

Sheep were reported as imported from England frequently and were generally used for wool. The sheep of Larzec, however, were noted for their milk production.

CARE OF CATTLE IN 18TH CENTURY—During the winter the cattle were stabled but the sheep were left out all the year. The stables were poorly constructed except in Flanders, where the

health of the animals was considered. In Bas Armagnac the stables were open to the wind and rain. In Poitou the hangers were covered with straw and debris which made disease ten times more liable to occur. When the cattle were stabled they were fed bean hulls, beech mast, carrots, wheat, hay, etc.

Cattle were generally pastured during the summer. When the pastures were good the cattle were good but when the pastures were poor the cattle suffered. A cow was milked two times a day.

In the 13th century the value of milk for cheese was for the 6 months from April 15 to October 15, 93 deniers,¹ and for the next 6 months, October 15 to April 14, it was only one denier. It appears from this that the cows did not give milk for the full year and further that the development must have been slow, as we find the following "By the end of the 17th century by the importation of cows from Flanders, they had obtained cows giving milk the whole year." (Enquete, 1902.)

DAIRYING IN THE 19TH CENTURY—At the beginning of the 19th century the minister of interior caused an inquiry to be made into the dairy industry of that epoch covering all France and a second part was added giving the condition of dairying in other countries. This inquiry was made in 1813 and while it was not completely responded to it gives valuable information for that period.

Cattle—BREEDS—The cattle of France have been shifting and changing for centuries and many of the so-called breeds were but crosses of two breeds and these crossed may have continued or after much development may have become a breed with well-marked characteristics, yet leaving many marks indicating the origin. All such changes have not ceased for up to the middle of the 19th century there were many "subbreeds." These subbreeds were offshoots of breeds and were generally found near the original breed.

Besides the French breeds which have been developed within the country there are also imported breeds which have been maintained in their original purity of type and qualities, such as Friesian, Shorthorn, Jersey, Brown Swiss, and Simmenthal. These

¹ One of a number of French coins of small value

imported breeds have retained their qualities and are considered only in their original habitat.

The principal breeds of cattle which might be considered as French dairy types are as follows: (Enquete).

Dairy types	Milk yield (1902)
	pounds
Normandy	6,614
Flemish	6,614
Ferrandaise	5,291
Montbeliard ..	5,291
Parenthenaise	3,748
Maroillaise ..	5,512
Aure	3,968
Breton	2,464
Salers	5,512

The yield of milk is for the full year or for the lactation period, which may be only 8 months.

Two breeds, the Limousine and the Charolais, which are generally considered as more of the beef type, give fairly good quantities of milk.

The dairy breeds, generally, are in different parts of the country but when a breed is in very dissimilar sections of the country it is very noticeable that the cattle do not develop equally. The appearance and milking qualities are affected by the difference in climate, feed, and the care received, regardless of the fact that they are of the same breed. The French breeds near the borders of the country resemble the breeds of the country across the border. Thus, near the Swiss border the French cattle resemble the Swiss cattle, and the same is true of the Spanish and Belgian borders.

It was officially asserted in 1922 that there were 35 or 40 breeds of cattle in France. If all the subbreeds are called breeds this would be quite true. However, it may be better to say that there are possibly that many kinds of cattle in France rather than breeds. If the subbreeds persist and become breeds the country will surely have an abundance of breeds. It was said also that 80 per cent of all cows in France were kept for milk.

One of the latest lists of breeds is shown in the annual show competition, prizes being offered for the following breeds in March, 1925:

- | | |
|--------------------------------|----------------------------|
| 1. Normande | 18. Jersey |
| 2. Flamande | 19. Charolaise |
| 3. Hollandaise | 20. Limousine |
| 4. Blue of the North | 21. Durham |
| 5. Salers | 22. Maine-Anjou |
| 6. Tachette de l'Est | 23. Armoricaire |
| 7. Montbeliard | 24. Gasconne noire |
| 8. Gessiegnée | 25. Garonnaise |
| 9. d'Abondance ou chablaisenne | 26. du Quercy |
| 10. Ferrandaie | 27. Bazadaise |
| 11. Brown of the Alps | 28. Gasconne areclee |
| 12. Tarine | 29. de St. Giron et d'Aure |
| 13. Parthenaise | 30. Lourdaise |
| 14. d'Aubrac | 31. des Pyrenees |
| 15. Bordelaise | 32. de Villars de lans |
| 16. Bretonne pie noire | 33. du Mezenc |
| 17. Bretonne froment | 34. Vosgianne |

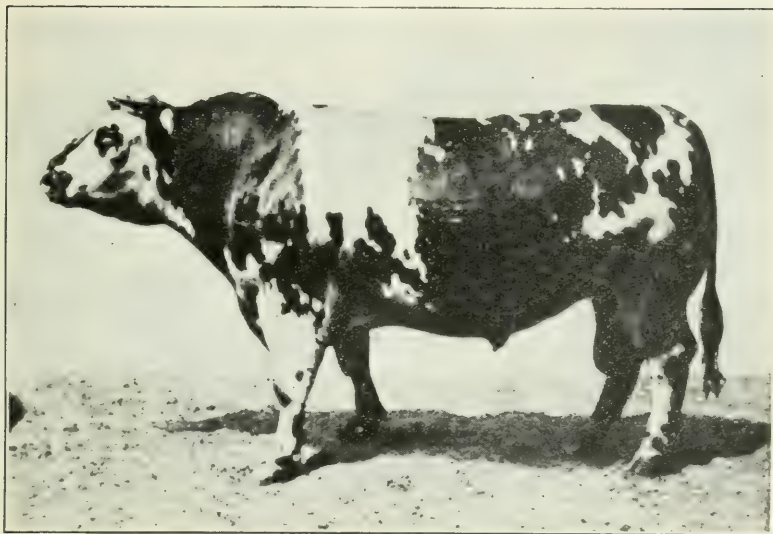
NORMANDY BREED—The origin of this breed is not known and French authorities state that no attempt has been made to trace its source. It is said to be the first dairy breed in the world; however, it would be difficult either to prove or disprove the statement. The breed is considered to be a product of the climate and soil of Normandy. Its principal center of existence is in the original habitat of four states of northwestern France, although the Normandy cow is to be found in all parts of the country.

The color of this breed varies but in general is brown, roan, red, or piebald, always having brown streaks on the body, from which it has sometimes been called "brindle." During the 19th century there was little change in the breed either in size, color, or characteristics.

The average milk yield varies but averages about 6,614 pounds a year. The fat content varies with the locality and feed, but is not high. It takes from 23 to 26 pounds of milk to make a pound of butter, less in winter and more in summer, within those limits.

This breed is large and bony and very unbecoming. It is almost the opposite of the usual dairy types and still is one of the best of dairy breeds. Some oxen of this breed become very large and an instance is recorded of an ox which weighed 4,185 pounds and measured 9 feet 9 inches from head to base of tail.

There are several subbreeds of this breed but the Contentine



Normandy Bull.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.



Normandy Cow.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

and Bessin are possibly the principal ones. The Contentine is noted for milk and when fresh gives milk enough to make 40 pounds of butter a month.

The Normandy cows are not turned loose in pastures but are staked out in line across a field, being moved from day to day. In winter they are fed hay, beets, turnips, cabbage, etc. In 1903 there were 1,600,000 head of the Normandy breed in the country.

FLEMISH BREED (Flamande)—The Flemish breed had its origin similar to that of the Black and White (Friesland) cattle of the Netherlands. The breed is not scattered over the country so much as other breeds but a few are found in Vosges and Seine-et-Oise departments. The breed is found principally in Flanders and is noted for its milk production; in a lactation period of 8 months in 1902, it showed an average of 6,000 pounds. The milk was fairly rich, as it required 23 to 24 pounds for a pound of butter. This breed has a red coat.

The Flemish breed with its subbreeds numbered in 1902, 670,000 head. The subbreeds are: Maroillaise, Boilonnaise, Saint Polainse, Artesienne, Guisarde, Picarde; the latter not differing much from the Flemish, and all subbreeds are in general good milkers.

BRETON BREED (Brittany)—The Breton breed numbered about 550,000 head in 1902. The yield of milk is small, only 1,200 pounds. The milk is rich, as it requires only 20 pounds to make a pound of butter. This breed is one of the smallest of French cattle but is very hardy and is valued chiefly for milk.

MONTBELIARD BREED—The Montbeliard breed bids fair to become the best cattle in the eastern part of the country. The milk yield is from 4,730 to 5,670 pounds and 24 pounds of the milk are required to make a pound of butter.

SALERS BREED—This breed is one of the oldest, and yields about 5,000 pounds of fairly rich milk a year. It is generally found in the mountainous parts of France. In 1902 there were approximately 500,000 in the region of the Avergne.

It is not necessary nor important to describe all the breeds. Many of the so-called breeds are crosses which are easily traceable

by their color, size, and general form. However, some of these subbreeds have maintained their individuality so long that they may be entitled to the designation of a breed.

HERDBOOKS OF FRENCH CATTLE—(By Meslay, Inter. Inst. of Agric. Rome, 1922)—

"Meslay emphasizes the great service rendered by pedigree books and herdbooks in showing the way to improve French breeds of cattle, and notes that there are still too few of these books in France. For the 30 or 35 breeds of cattle there are scarcely 15 herdbooks, of which only 8 or 10 are fully successful: the others are embryonic or in the course of formation. Some of the herdbooks are already 35 years old and some progress has been made, but other books of more recent date are not less successful.

"The different herdbooks on which information has been obtained are as follows:

1. The herdbook of the Montbeliard breed.
2. The herdbook of the Limousine breed (beef).
3. The herdbook of the Charolaise breed of Nièvre (beef), Saône-et-Loire, comprising a total of 11,000 entries of cows and heifers and about 5,000 bulls.
4. The herdbook of the Normandy breed of cattle, a successful collection of 18,000 to 20,000 cows, heifers, and bulls.
5. The herdbook of the Continental Jersey breed.
6. The herdbook of the Parthenaise breed with a family of subbreed called Maraichine, very good milkers and hardy, for which a herdbook has not been compiled.
7. The herdbook of the Garonnaise breed.
8. The herdbook of the Bazadaise breed.
9. The herdbook of the Marne-Anjac breed, comprising 1,500 members and which has entries of about 8,000 animals.
10. The herdbook of the Black Piebald Breton breed of Finistère and Morbihan.
11. The herdbook of the Armoricaire breed, a cross between the Black Piebald and Durham breeds, with entries of 713 animals.
12. The herdbook of the Red Piebald Breton breed, very clearly distinguished from the two latter.
13. The herdbook of the Pyrenean breed of the southwest with pink mucosae.
14. The herdbook of the Tarentaise breed, in process of compilation.

"Besides these herdbooks there are a great number of syndicates created before the war, and other small communal societies with bull owners. It would be desirable that these breeding syndicates should first endeavor to maintain pure breeds in the districts where these exist, and then to compile for each of the breeds a pedigree book or herdbook."

Possibly the latest herdbook established was started in October, 1922, for the Vosges cattle, by the agricultural director of Alsace-Lorraine; color, black, white patches on back and white stripes from front to groin; single purpose; milk rich in fat, yield average from 4,900 to 5,200 pounds.

METHODS AND PRACTICES—In Flanders the milking is done in the barns, in Normandy in fair weather it is done in the pastures in summer. The little cows of Aure are milked three times a day but in other parts of Normandy it is done only twice a day, as in Breton. In Auvergne, in the mountains, the cows are milked in the pastures and the milk is made at once into butter or cheese in the "chalets." In other mountain sections the cows are called for milking and the calves allowed to take part of the milk, but when the cows are again turned to pasture the calves are confined.

Louis Pasteur (1822-1895) began the study of fermentations in 1854 and proved that fermentations were produced by the



Dr. Pasteur.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

action of yeast changing the sugar to alcohol and carbonic acid. His discovery of butyric acid bacilli was made while studying fermentations. He next showed that "spontaneous generation" was a myth and that the "generation" was due to germ life.

His greatest interest to the dairy industry is his study of milk from the year 1857 to 1862 during which time he showed that the souring of milk was due to germs, generally from the air, and that by heating milk to 234° F. the germs may be killed and the milk thereby sterilized.

Pasteur lived long enough to see the beginning of the adoption of pasteurization by the dairy industry.

The largest market for fluid milk is Paris and many of the cooperative societies of farmers were organized to supply that market. Three kinds of milk were recognized: "Milk ordinary," "milk superior," and "milk de lux;" the last kind was pasteurized, sterilized, or maternized.

Milk cows are pastured from about May 1 to November 15. and are stabled the rest of the time. The winter feed is hay, carrots, cabbage, pulp of beets, or brewers' grains; though this is added in the neighborhood of Lille, for cows in full milk, a mash of pulverized beans or oilcake. Other roots are also used: Parsnips, beet roots, potatoes, artichokes, turnips, and rutabagas. Very little grain is used.

The growth in population and prosperity of the people brought an increased consumption of meat and dairy products.

The retarded breeding of cattle in France is explained in part by the division of lands. While the breeding was neglected by the farmers for many years it was specially handicapped after the revolution and the division of lands. The division of lands originated when the lands of the nobles was taken and sold at auction to the peasantry and the laws of succession instituted. It provided that each heir could claim and receive his share of the inheritance in kind, and each share was to be equal. Those who did not have lands flocked to the cities and the labor on farms became inadequate.

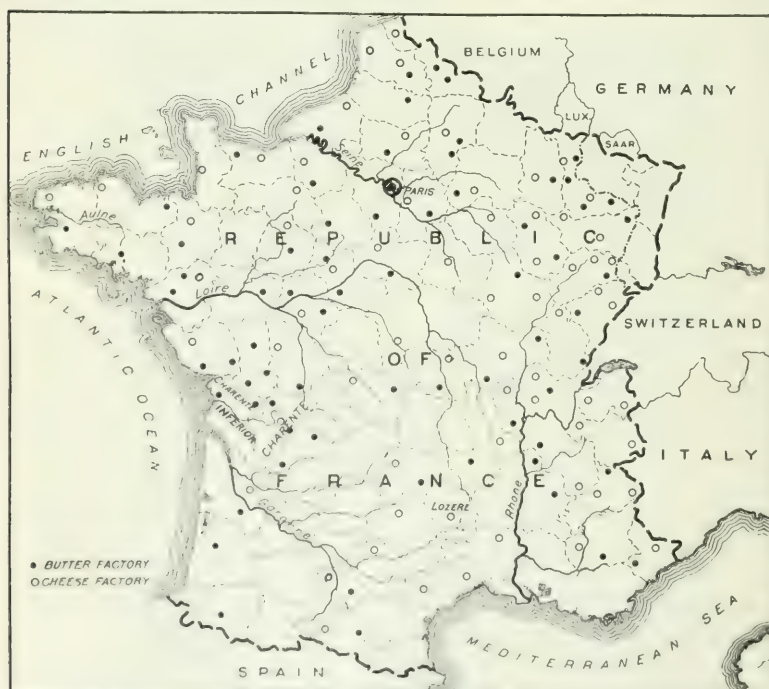
BUTTER—In southern France the per capita consumption of butter is small. In many households butter is served only a few times a month, as it is considered a luxury. Vegetable oil is used for cooking. The consumption of butter in 1882 was but

2.5 pounds per person for the whole of France and in 1892 it was 5.9 pounds, in 1906 it has risen to 8 pounds, and in 1923 it was 10.9 pounds. There was for the same period a decrease in the exports of butter and whole milk and an increase in the production of butter. During the World War there was a decrease in the consumption of butter.

The consumption of milk in Paris is possibly the largest in the country and averaged, in 1896, 14.7 gallons per person, in 1910 110 gallons, in 1919 17.2 gallons, and for 1924 it was 28.3 gallons per person.

The average consumption of milk for the whole of France was estimated in 1922 at 21.5 gallons.

Cheese is always a part of the meal in France whether butter is served or not. Brie cheese is eaten on bread and Roquefort is generally mixed half and half with butter and spread on bread. Cheese is not used much in cooking in France. The consumption of cheese per person in 1892 was only 8.1 pounds, but in 1923 it



Distribution map—each dot represents a number of factories.

was 13.5 pounds. The consumption of cheese in Paris is estimated at 12 pounds per person a year.

COOPERATION—Ever since the tentative efforts among the rural population of Gaul and medieval France, the spirit of association has had a regular development, beginning with the *de facto* group, until it has arrived at the present form of legal association regulated by special statute.

The first unions of farmers in groups seem to date back to the days of the Roman domination and the invasions of the Visigoths and Arabs. First, the unions were interested in the drainage of land, caring for irrigation canals, maintaining dikes, etc.

The first cause of agricultural syndicates' great development is economic. It was first turned toward purchasing commercial fertilizer and later toward machinery and superior animals for breeding purposes.

The direct origin of the cooperative societies of production and sale seems to date from the 12th century, at which period "fruitieres" were formed in the Alps, the central mountain land and the Pyrenees. These groups, still existing under the name "fruitieres" in the Jura Alps, "Cabanes" and "Baraques" in the Pyrenees, were formed for the purpose of manufacturing cheese, chiefly Gruyere. These societies, of which some are very ancient, are numerous today. There are about 1,800 fruitieres in the mountain regions.

CHANGING FROM GRAPES TO DAIRYING — A portion of the provinces of Charentes, Lower Charentes, and Deux-Sevres, was formerly rich in vineyards. When the phylloxera appeared, just prior to 1880, all this was changed. By 1885 the last vintage was harvested in this section. The wine growers were ruined. They rooted up the useless vines and planted corn and grasses. The meadows produced fine grasses and enabled the owners to put in a few dairy cows. Just then the first separator appeared in France (1878) and industrial dairies (factories) began to prosper, for they had absolute control. The milk could not be turned by the farmers to any other purpose, so it was sold to the creameries.

In 1888, at Chailly, the first cooperative creamery was founded. While it was crude it succeeded. The example was fol-

lowed in the section where the grapes had been destroyed and from 1895 to 1914 70 associations were organized.

In 1897 M. Martin, director of the dairy industry of Mamirolle, visited the district and corrected the errors of organization and encouraged the farmers to develop the industry. But a commercial organization was still wanted and in 1893 the Central Association of Cooperative Dairies of the Chartres and Poitou was founded and since that date has included nearly all the dairies of the district. It founded an inspection service in 1897, and in 1903 established a professional school at Surgeres. He also helped to obtain competent workmen and in securing refrigerating machinery. Since 1897 this district has had a service of refrigerated trucks for delivering butter to Paris.

The records of the cooperative societies are excellent and show the condition throughout the year and the progress year by year. This section, which was threatened by poverty in 1897, was prospering in 1914. The land was better cultivated, the people more satisfied, and it is asserted that the general emigration to the cities had entirely stopped.

In 1913 there were in Chartres and Poitou 129 cooperative factories with 75,000 patrons and 195,000 cows contributing. These cows provided 85 million gallons of milk in the year.

Cooperative cheese factories in the Vosges mountains are very old. There were, in 1912, 1,800 of these cooperative cheese factories, which are small and cost only about \$200 to \$300.

The total number of butter factories in France in 1902 was 2,000 of which 685 were cooperative.

DEVELOPMENT—It appears that butter is still seeking its discoverer. Thompson in *British Dairying* says:

"When the making of butter originated is in the night of time. The Greeks learned it from the Scythians, and the Romans from the Germans. Whatever the origin butter had nothing of its perfection as it has had since the application of modern science."

The commerce in dairy products was not large before the 18th century. Milk, butter, and cheese were generally consumed in the family. These products seldom sold well. That is, seldom could a market be found. Milk was difficult to conserve. In 1707 milk sold in Paris streets by milkmaids who cried their wares. In the

18th century the villages had cows, asses, and goats, to produce their milk. These were driven around and the milk sold warm. The price of the milk varied from 6 to 33 centimes. In 1385 in Paris milk sold for 19 centimes.

Fresh, unsalted butter, was hard to keep. The trade in salted butter was more important than fresh butter. Normandy furnished the most of the salted butter. In the 18th century butter from Isigny was said to have been the most prized butter in the world.

France in the 18th century was an importer of butter, principally from Belgium, Great Britain, and Netherlands. Butter from Dixmude, Belgium, was preferred. The French government placed a tariff on cheese and butter in the 17th and 18th centuries but toward the end of the 18th century it was removed for England, Scotland, and Ireland, as France's domestic production was insufficient for domestic demands.

As early as 1322 cheese at Champaign sold for 10 franks 70 centimes per kilogram, while in 1344 it was only 1 frank 80 centimes. Gruyere cheese in 1535 sold at 1 frank 35 pieces, per kilogram. Roquefort sold for 1 frank 45 centimes per kilogram in 1556. These early prices show the existence of cheese on sale but the value of the money is very uncertain.

The manufacture of Camembert cheese dates from the 18th century. It was first made by Mme. Harel in 1791, and sold first at the market of d'Argentan. In 1813 her daughter took up the making of this cheese and it was introduced into other parts of France.

Most of the cheeses were originated at an early date and practically developed into present forms and flavors. At that time all the work of making cheese was done by the women and it appears that all the principal cheeses were discovered by women. Some of the principal cheeses of France are: Neufchatel, Gournay, d'Olivet, Gace, Rollet, Macquelines, Compiègne, Troyes, Saint-Florentin, Langres, Gruyere, Port Salut, Roquefort (sheep's milk).

It was not until the Franco-German War that the fine butter made in Normandy began to go to England, Paris being unable to get it on account of the siege. It was then, too, that the now famous Camembert cheese commenced to find its way into the world markets.

For a long time butter was exported to England in three brands or qualities by Eretel Feres, of Valognes. Their agents attended the markets to which the farmers sent their butter in large lumps. The agent placed his price on the butter and the farmer had the option of accepting or refusing it. Each lot was placed in a basket and dispatched to Valognes, each day's purchases being arranged on a long bench and valued by the expert of the establishment, who placed each lot in a class by itself and priced it accordingly. The first grade was of very high quality and easily won the first place in the English market.

ROQUEFORT CHEESE—Pliny, who lived in the first century, said that the cheese most appreciated of all the countries in the world was from the Province of Lozere. It is believed that he meant Roquefort cheese. Records of its manufacture reach back into antiquity. Francis I confirmed all the rights they claimed over the caves and cheese. In 1550 the parliament of Toulouse granted a monopoly for the manufacture of cheese and a record of Philippe I in 1070 mentions one of two cheeses on the domain of Frotard de Cornus. The cheese is made in the southeast part of the department. The number of factories in 1901 was 12, and the total product was made from 485,000 gallons of milk, and amounted to 630,000 pounds of fresh cheese. There was a grand society of the caves of Roquefort which made all the cheese. Cheese is manufactured for 100 days, that is, from April 29 to August 6, inclusive. It was usual to use the milk of one cow with that of 100 sheep's milk. Each sheep gave from 77 to 88 quarts a season and the cow's yield was approximately 4,000 pounds. The number of sheep in the department in 1901 was 34,515 and there were also 110 cows. The weight of the cheese varied from 4.5 to 6.5 pounds and averaged 5.5 pounds.

In 1896 and 1897 Roquefort cheesemaking passed a very critical time in its history. The price dropped very low, possibly due to quality of product and poor workmanship, hauling the milk too far, and using too much cow's milk in the manufacture of the cheese. At present (1925) the industry is very prosperous.

The manufacture of Roquefort cheese remained a long time in the hands of the farmers. The cheese was simply held in the caves until matured. The condition of the caves at Roquefort was the

best, with a temperature of 8° C. (46° F.) and currents of fresh, moist air circulating continuously.

The society also has caves artificially cooled with refrigerators and these caves also mature the cheese naturally.

The estimated production of Roquefort cheese in 1920 was 11,023,000 pounds.

GEROME CHEESE—This cheese is made in the Vosges mountains. Mention is made of it in a diploma given in 1070 by Henry IV and it is known to have been made in the 7th century.

GRUYERE CHEESE—This cheese is supposed to have originated with the "fruitieres" in the Alps and Vosges mountains. It is known to have been made in Doubs in 1288.

Gruyere cheese is very similar to Swiss, or Emmenthal, and sometimes the names are used interchangeably; however, in some sections of Europe the Gruyere cheese is part skim cheese.

PATE FERME (Pate bleue) — This cheese is the same as Roquefort except that it is made of cow's milk instead of sheep's milk.

MILK SHEEP—The two principal breeds of sheep were from the Barbary sheep and are called Sahune and Larzacs. These have been developed for the production of milk. The Larzacs in 1785 gave annually milk enough to make 13 pounds of Roquefort cheese, but now they produce enough to make 30 or 40 pounds and exceptionally good milk sheep may go as high as 55 pounds of cheese. The Larzac sheep give about one quart of milk a day on an average but the best give two quarts daily and the average of all is estimated at 20 gallons a year. There were in 1922 about 500,000 head of sheep yielding a total of 82,500 gallons of milk annually, four-fifths of which is made into cheese and the remainder was for the use of the farmers.

The number of milk ewes in France in December, 1920, was 5,817,000. Most of the milk is consumed by lambs but 27,500,000 pounds were used in the manufacture of cheese.

MILK GOATS—The development of goats in France has followed that of Switzerland and Germany. There are a number

of kinds of goats and each seems to have special merit. The milk is usually consumed in the villages of the Mediterranean and the southwest. In Paris the goats are driven through the streets delivering the milk by the glass. The breeds of goats are: Maltaise, de la Murcie, de la Manca, des Pyrenees, des Alpes, etc., taking the name largely from the location.

Other than for drinking purposes the milk is used for the making of a cheese called Chevet, which is a very old cheese.

The mixing of sheep and goats' milk facilitates the making of Roquefort cheese, as it gives a larger quantity of milk to be utilized.

The dairy goats of Mont d'or are very good milkers, giving from 3 to 4 quarts of milk a day, on the average, and attain as high as 6 to 8 quarts a day. The lactation period is, however, only 5 months.

At the present time (1925) there is much interest developing in goats. The 1,340,000 goats of France produce about 33 gallons of milk per animal each year, or about 55,000,000 gallons in all per year. A part of this is used for making cheese.

CONDENSED MILK—For the purpose of getting a product that would keep well the condensing and concentration of milk was conceived. The condensed milk industry is indebted to French scientists for a large part of its success. Appert was the first to get the idea and in 1827 condensed milk to the consistency of the white of an egg. A little later Martin de Lignac added 75 grams of sugar per liter, after reducing 5 times, then put into bottles and heated in an autoclave to 104° F. Gallais attempted to reduce the air in the milk, and Gail Borden in America in 1850-1860 condensed in vacuum.

While the interest in the manufacture of condensed milk is lacking in France, still the exports of condensed milk have reached more than 6 million pounds; however, the imports at the same time reached more than 100 million pounds.

TRADE AND MARKETS—While the production and use of milk and its products have been an important part of French economy in food for centuries, it is well to note that trade in these products with foreign countries was very limited during the entire period prior to the development of stable government under

Charlemagne and then there was another wait for transportation facilities. Improved transportation on land and sea were developed from 1850 to 1880, and the development of railroads and steamships was immediately followed by enlarged international trade in dairy products, especially after refrigeration was added to the steamship service, about 1875.

It is true that the trade in cheese was already important as the sailing vessels could carry it aboard without deterioration and it was then, as now, a very substantial food, always ready for consumption. In the early days, when refrigeration was unknown and the practice of carrying ice was not practiced, much trouble was experienced in the long trips when green vegetables and fresh meat could not be obtained; hence, the cheese served largely as food and medicine for the early navigators.

The adulteration of market milk is not a new thing nor has it been winked at by previous generations. Note the following drastic regulation:

In olden days France decreed that, "A funnel shall be placed in the mouth of anyone convicted of selling watered milk, and that the said milk shall be poured down said funnel until such time as a doctor shall declare the culprit incapable of swallowing any more without danger of death."

France was one of the first countries to can butter for export (1880) and that country and Denmark and Germany were for years the only exporters of tinned butter especially suited for use on shipboard.

As the United Kingdom requires more than one-half of the butter in international trade France has always found it to be a ready purchaser of butter, and the exports to the United Kingdom always have been larger than to any other country.

The foreign trade showing volume of dairy products may be summarized as follows: For the period from 1909 to 1913 the butter exports averaged 45,676,000 pounds and the imports averaged 13,713,000 pounds, making a net export of more than 30 million pounds. The cheese exports for the same period averaged 32,000,000 pounds and the imports were 49,056,000 pounds, making a net import of more than 17 million pounds. France has been an importer of cheese for more than 75 years. The exports of concentrated milk for the period of 1909 to 1913 aver-

aged 1,900,000 more than the imports, while milk powder was only 761,000 pounds greater in imports than in exports.

Due to the World War the trade was much lower during the period 1914 to 1920 and in 1924 the exports of butter were slightly more than the imports, the imports of cheese were 5 million pounds greater than the exports, while the imports of concentrated milk were 19 million pounds larger than the exports. The imports of milk powder had also increased until in 1923 they were 2½ million pounds net.

The following is a list of the schools where some part of the course includes dairy subjects:

LOCATION	SCHOOL
Coetlogen Lle-et-Villaine	Dairy school for girls.
Collonges Ain	Cheesemaking school.
Cuelhues	Cheesemaking school.
Grande-Chartreuse	Regional dairy school
Hanvec Finistere	Practical school for girls.
Maillat Ain	Cheesemaking.
Manche	Agriculture and dairying.
Marjevals, Lozere	Winter dairy school for girls.
Monastier	Domestic science and dairying.
Nancy	Dairy school.
Ruffieu Ain	Cheesemaking.
Surgeres	Professional dairy school.
Departments. Cortes-du Nord; Lozere; Nord;	
Pas-de-Calais and Oise	Traveling dairy schools

CHRONOLOGICAL EVENTS

4000 to 2000 B. C.	The country contained cattle and sheep.
Very early	Salers breed of cattle originated.
1st century	Roquefort being made in province of Lozere.
450 A. D.	Franks entered the country and brought cattle.
7th century	Gerome cheese made in Vosges Mountains.
768-814	Charlemagne established feudalism and introduced Christianity throughout his realm.
1066	Norman conquest of England, carried cattle to England.
1107-1137	Louis VI abolished serfdom.
Gallo-Roman era	Little progress made.
1288	Gruyere cheese was made in Doubs.
1348	Butter price 3 to 4 francs a kilogram.
1385	Milk in Paris was 19 centimes a liter.
15th century	Sainfoin grass grown in early years of century.
1698	Number of cows in Flanders estimated at 50,000.
18th century	Isigny butter prized throughout the world.
1800	Cows imported from Flanders gave milk a full year.
Up to 1800	Cattle remained undeveloped.
1707	Milkmaids hawked milk on streets of Paris.
1773	"Epizootic" (foot-and-mouth disease) broke out and many cattle died.
1778	Swiss cattle introduced by M. de Rouge. (Probably Brown Swiss).
1778-84	Celles de M. Deulaux doing scientific work on dairy products.
1785	Larzac sheep milked and milk used for cheesemaking
1787	Cattle of large size imported from Flanders.
French Revolution	
1791	Camembert cheese first made by Mme. Herel.
17th and 18th centuries	France placed a tariff on butter and cheese from Belgium, Netherlands, and England, but removed it by the end of the 18th century.
1813	Minister of interior had an inquiry made into the dairy industry.
1827	Appert made first condensed milk, like white of egg. Lagnac added sugar to condensed milk, 75 grams per liter.
1854	The Government instituted annual shows for best cattle.
1857	Louis Pasteur discovered pasteurization.
1870	War with Germany.
1870	Normandy began shipping butter and Camembert cheese to Great Britain when Paris was under siege.
1887	Herdbooks for principal breeds began.

1902	Only three milk-powder plants in France.
1902	August Ganlin invented the homogenizer.
1905	Joseph Millman invented the first regenerative pasteurizer.
1922	Herdbook of Vosges cattle established.

NUMBER OF COWS, TOTAL CATTLE, SHEEP EWES, GOATS IN FRANCE
(Annuaire Statistique, Statistique agricole annuelle)

Year	Cows	Total Cattle	Sheep	Ewes	Goats
1830	4,628,317	9,130,632	13,732,492		737,888
1840	5,501,825	11,761,538	14,804,946		964,300
1852	5,781,465	11,970,737			
1862	6,408,261	12,811,589	14,572,430		1,216,774
1882	6,587,639	12,997,054	9,758,528		2,336,332
1892	6,673,460	13,708,997	8,804,401		1,335,736
1900	7,819,582	14,520,832	20,180,000		1,558,000
1910	7,596,250	14,532,030	17,111,000	9,753,700	1,418,000
1915 ¹	6,266,035	12,514,414	13,483,189	7,490,810	1,230,000
1920 ²	6,544,460	12,755,720	9,376,630	5,817,700	1,340,890
1921	6,972,890	13,343,440	5,936,520	5,936,520	1,361,180
1922	7,169,670	13,575,840	9,782,420	6,028,100	1,368,140
1923	7,303,940	13,749,290	9,925,210	6,115,350	1,352,630
1924	7,431,400	14,024,966			1,376,510

¹ Not Including Invaded Portion.

² Including Alsace and Lorraine, 1920, and thereafter.

TOTAL PRODUCTION OF MILK FROM COWS
(Milk and its Productions, Rome)

Year	Total Milk	Milk Fed to to Calves	Milk for Butter	Milk for Cheese
	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds
1882	15,483,000			
1892	17,482,000			
1902	19,171,000			
1913	29,072,526	6,579,920	9,589,350	3,558,255
1914	11,287,000			
1916	8,677,000			
1921	24,176,306			
1922	25,713,872			
1923	26,567,653	5,796,860	8,621,185	3,599,321

TOTAL MILK RECEIPTS INTO PARIS
(L'Industrie Laitiere)

Year	Total Milk	Year	Total Milk
	Gallons		Gallons
1896	22,858,000	1916	63,377,000
1901	52,150,000	1917	56,586,000
1906	66,570,000	1919	56,770,000 ¹
1910	70,366,000	1923	80,649,000 ¹
1915	62,077,000	1924	79,222,000

¹ Receipts by Railroads Only.

IMPORTS OF BUTTER, CHEESE, AND CONDENSED MILK
(Tableau general de commerce de la France)

Year	Butter	Cheese	Condensed Milk
	1,000 Pounds	1,000 Pounds	1,000 Pounds
1850	3,494	9,569	.....
1860	3,927	11,493	.....
1870	6,635	23,756	.....
1880	15,642	34,812	8,718
1890	14,165	28,726	608
1900	13,559	42,635	1,071
1910	10,656	49,011	1,632
1915	1,711	46,744	8,525
1916	625	24,139	21,895
1917	742	12,047	87,653
1918	1,984	11,206	33,404
1919	12,789	15,238	103,496
1920	16,354	21,231	64,338
1921	40,140	35,146	30,638
1922	65,364	60,289	32,922
1923	20,877	45,690	25,124
1924	6,862	39,044	24,168

EXPORTS OF BUTTER, CHEESE, AND CONDENSED MILK
(Tableau general de commerce de la France)

Year	Butter	Cheese	Condensed Milk
	1,000 Pounds	1,000 Pounds	1,000 Pounds
1850	4,870	1,866	.....
1860	26,073	3,459	.....
1870	42,301	4,672	.....
1880	68,485	9,408	.....
1890	89,785	12,232	168
1900	44,658	18,468	1,595
1910	48,428	25,161	4,251
1915	50,336	16,242	6,370
1916	18,937	11,704	2,206
1917	6,728	7,403	932
1918	2,620	5,213	727
1919	995	6,159	2,117
1920	4,234	12,710	15,425
1921	2,701	14,381	9,456
1922	6,798	22,019	7,349
1923	17,314	27,908	7,483
1924	8,983	34,394	5,256

GERMANY

NATURAL CONDITIONS—Germany lies on the northern slope of the Alps Mountains, reaching from the crest of the mountains to the Baltic and North Seas. It has a variation of soils and grasses and an abundance of water, and is, therefore, well suited to dairying. The rainfall varies from 12 inches to 59 inches while the mean temperature is from 43° to 51° F.

While it is recognized that Germany is an industrial country its meadows are also important as in 1900 they covered 11 per cent of its surface and the pasture and grazing lands covered 5 per cent more. Agriculture is very important, but is considered secondary to manufactures. The farms of Germany are well equipped and efficiently operated.

The country maintains millions of cattle, horses, sheep, goats, and swine, and produces most of the feed for all of its livestock. The products of all these animals and much more are consumed domestically.

EARLY CONDITIONS—Prior to the Middle Ages the possibility of fixed habitation was as remote and uncertain as the government in that section of Europe. The wandering hordes passed and repassed over the territory for hundreds of years, destroying anything that appeared in the way of improvements and carrying all cattle and other movable property with them. When the government became more stable and could protect its citizens in their homes, livestock accumulated rapidly. While there was plenty of wild game in the country the need for cattle was not so great. Transportation, mostly by water, limited opportunity for sale of dairy products; hence, the produce of the country was consumed within or near its boundaries.

CATTLE—According to the earliest records there were cattle in the whole of Germany. The facts are briefly stated by Morse, a synopsis of which follows:

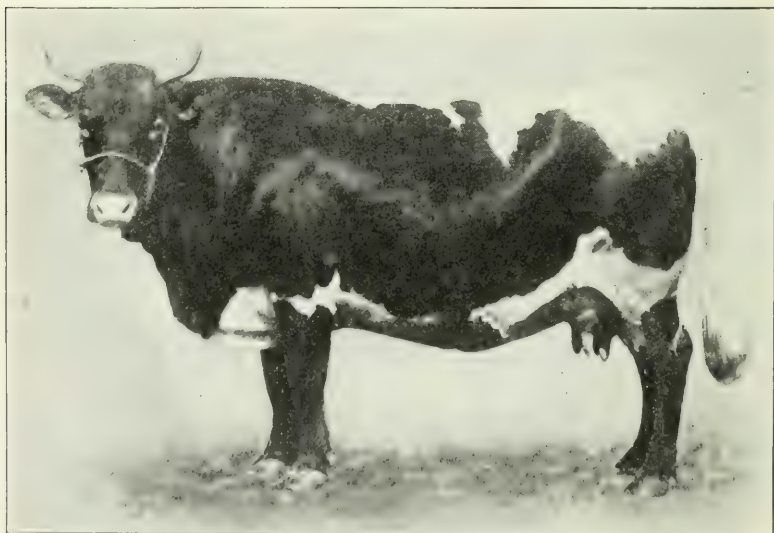
"From Tacitus and other authors we find that in the land of the Germans there were many cattle all of which were small. Caesar says that their food (Germans) consisted of milk, cheese, and fish. Others say that it was wild

fruit and evening or coagulated milk, but this did not mean cheese. Pliny says that the Germans were ignorant of the process of making cheese.

"At the beginning of the 5th century the Allemans went from south Germany to east Switzerland, carrying the red Celtic breed of cattle and crossed it with the longhead (Longefrons) cattle, giving rise to the 'Algauer' breed. The yellow breed of Oberinthalers may also have arisen in a similar manner after the Gauls entered Rhetia says Werner.

"In northern Germany the cattle are similar to those of the Netherlands while in the southern part they are more like the cattle of Switzerland. In the middle part of the empire are a variety of breeds which are little known outside of their native districts."

It is difficult to discuss the cattle breeds of Germany as the classification varies with the author. Some writers give all the variations found and consider each a distinct breed, while the other extreme gives practically no breeds, claiming that the types found are but crosses of breeds of bordering countries. The facts are near the middle of these statements. As Morse says, the north and south of Germany have cattle which resemble and really have been derived from the breeds of Netherlands and Switzerland, but some of these imported breeds were crossed with native cattle and as the crosses were encouraging they have been segregated and bred pure for many years. This has been true in much of Germany.



Pinzgau Cow, Germany.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

The following statement of the breeds of Bavaria is from an American Consul report, in 1887:

Breed	Annual milk yield	
	Pounds	Origin
Pinzgauer	5,500	Bavarian race, bred pure 100 years.
Miesbacher	5,060	Pinzgauer and Simmenthal cross, pure 30 years
Simmenthal	5,500	Swiss, bred pure 30 years. (In Germany.)
Ansbacher	5,500	Ostfries and Berne, pure 125 years.
Kelheimer	3,300	Bavarian race, pure 100 years.
Allgauer	6,600	Swiss (gray and brown), pure 100 years.
Glan Donnersberger	4,400	Bavarian race, pure 100 years.
Scheinfelder	4,400	Bavarian race, pure 100 years.
Ellinger	5,500	Red Bavarian and Allgauer, pure 60 years.
Voigtlander	3,300	Tyrol, pure 100 years.
Murnau-Werdenfelser	4,950	Swiss-Wurzhthal and Montefumer mixed, pure 20 years.
Bayreuther-Schacken	4,400	Bavarian, mixed with Berne and Miesbach. (Still in formation).

Possibly one of the best classifications of German cattle is obtained by dividing them according to the elevation of the land, as: Low lands, mountainous, and the middle breeds.

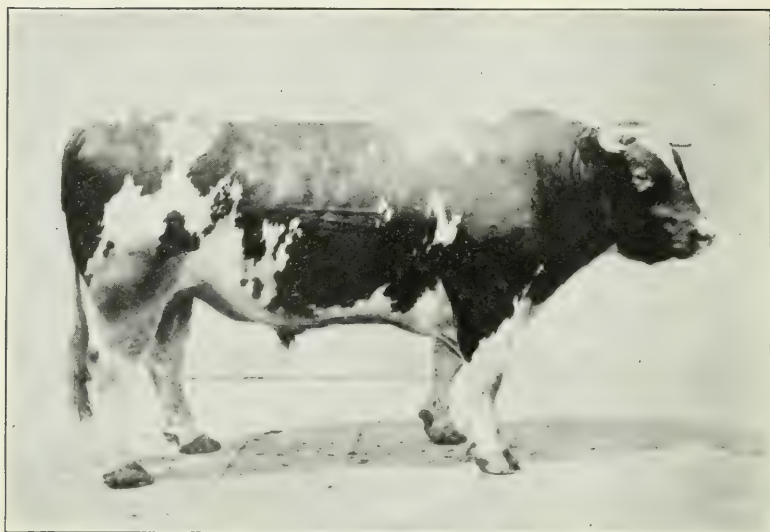
In the lowlands the cattle have good soil and stable feeding. They are mostly of the Dutch breed, or derived from it, and are used for market milk production.

In the mountainous and rocky region, where the soil is heavy, the Simmenthal and Montefau (Swiss breed) are used for milk, butter, beef, and labor.

In the middle section the Allgauer breed is found, and they are also used for milk, butter, beef and labor.

The principal center of cattle breeding is in Bavaria and Wurttemberg. Livestock is, comparatively speaking, not very dense in Germany. In southern Germany Swiss cattle are usually drawn upon for improvement of the stock. The Friesian cattle are scattered all over Germany and are the principal breed for milk production, although often crossed with other breeds. The markings of this breed are found in many German breeds which have long been bred pure from outside blood.

In the 13th century Dutch colonists took cattle to Pomerania, on the Baltic, and the present breeds now found there are from these cattle, but they are not equal to the Dutch cattle in Holland.



Red-and-White Lowland Bull, Germany.



Red-and-White Cow, Lowlands, Germany.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

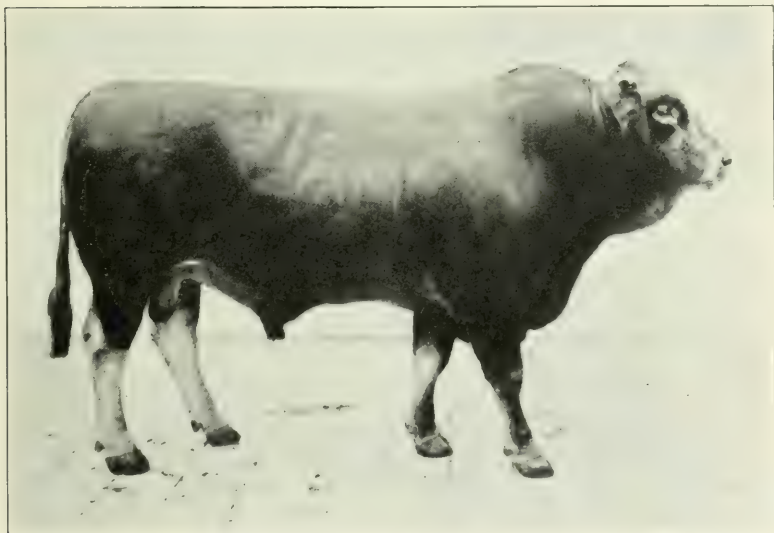
The following is a running description of the various breeds and subbreeds together with many of the crosses which may or may not now be bred free from outside blood and, therefore, may be classed either as a breed, or type of a breed.

BREEDS—Low-country breeds include: Dutch, Oldenberg, Dessau, Old Margraves, Angelers, Wilstermarsh, Breitenburg, and a number of English breeds.

Mountain breeds include: Simmenthal, Berne, Pinzgau, and Voigtland.

The middle section includes: The Algau (Allgauer) breed. This breed is practically the only breed in this section.

Oldenberg breed is found in the Weser marshes, is black and white and is sometimes called Budjadinger breed. The cows of this breed are very good milk producers.



Yellow Franken Bull, Germany.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

Dutch breed—This is the Friesian breed of The Netherlands, or a variation or grade of that breed. This breed is noted for its large milk production.

The *Montafau* breed is very heavy, dark brown in color, and come from the region of Tyrol, and are also noted for large milk production. It is a branch of the Brown Swiss and is spread over a large part of the country.

The *Necker* breed is located in Wurttemberg, is large, red in color, and are good in milk production.

The *Simmenthal* breed is used mainly to improve the German breeds in southern Germany. (See Switzerland).

The *Limbourg* breed is located in Wurttemberg, of a silver-yellow color, and have a milk yield of about 3,960 pounds per year.

The *Friesdorf* breed originated in middle Franconia, Bavaria, and is used principally for draft and beef purposes, while the yield of milk per year is about 3,000 pounds.

The *Alb* breed, of southern Germany, has a yellowish-red coat, and when crossed with the Simmenthal make good milk producers.

The *Schwab Hall* breed of Schwabisch Hall, are dark red or chestnut-brown and are used for draft and beef.

The *Miesbacher* breed is derived from the Pinzgauer and Fruitiger breeds. It is found in the Bavarian Mountains, is small, white, with yellow or red spots, and are considered a good milk producing breed.

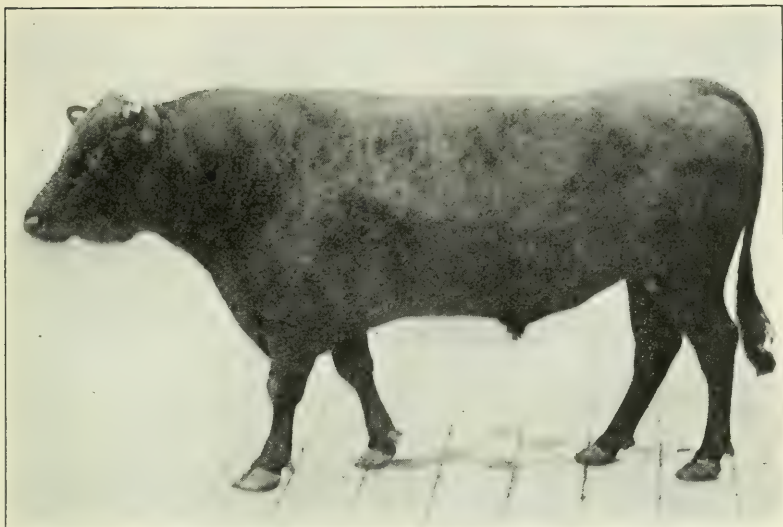
The *Algau* (Allgauer) breed originated in the Alpine regions and spread over a large part of Germany. The cattle are brown gray in color, and are said to be good feeders, and the yield of milk is about 4,350 pounds a year.

Brown Swiss, or *Schwytzer*. This is the Swiss breed and is the same in all countries when bred pure. (See Switzerland).

The *Voigtland* breed is found in Saxony, Bavaria, and Bohemia, is small, and the yield of milk is about 3,000 pounds a year. Origin: They are a cross of native cattle with Tyrol cattle which was made in the present century.

The *Angler* (Angel) breed of Schleswig, is red brown, medium in size, frugal feeders, and the cows are good milkers.

The *Podolische* breed (Podolian) (Steppe) originated in southern Russia, and brought the "rinderpest" into Germany; however, this breed is noted for freedom from foot-and-mouth



Angeln Bull, Germany.



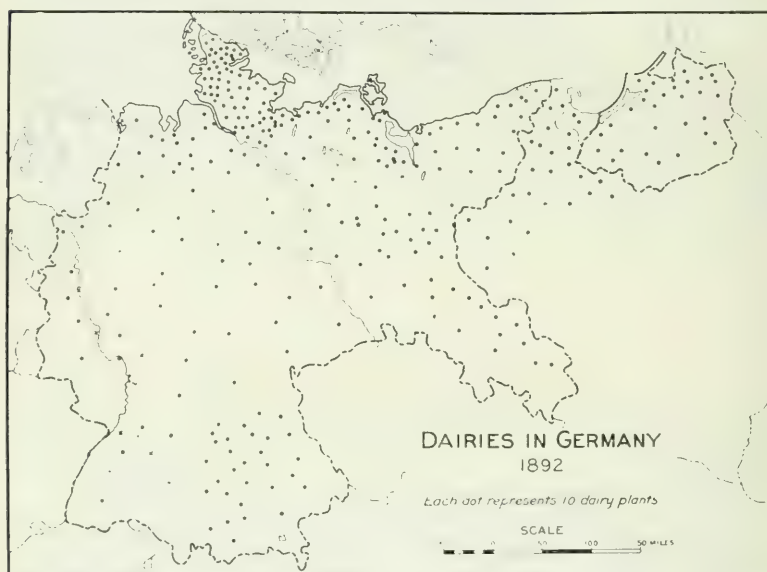
Angeln Cow, Germany.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

disease and tuberculosis. The animal in Germany is small and the meat is excellent but as milk producers it is one of the poorest.

The *Murzthaler* breed of southeastern Bavaria is gray in color, heavier than the Podolian, and yields more milk. This breed represents a connection between the steppe and mountain cattle.

COOPERATION—If by the cooperative idea is meant the idea of association it is found in the habits of the ancient village communities with common rights to land, forests, water, etc.

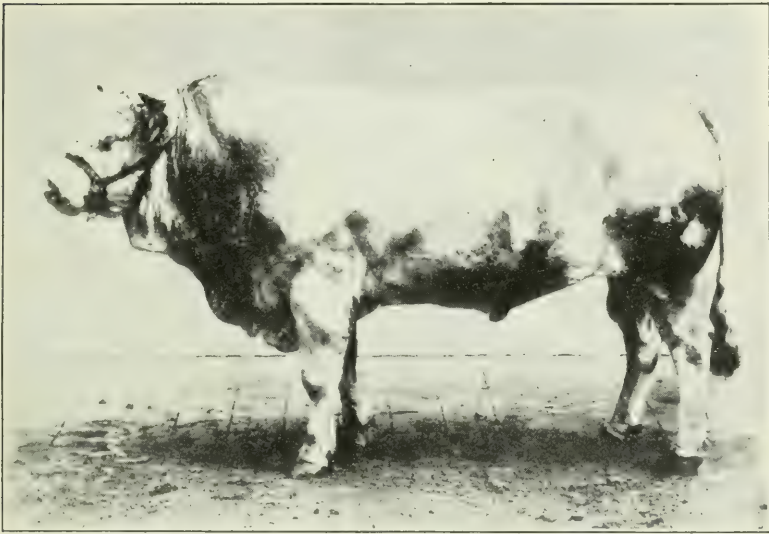


Most of these ancient cooperative habits have disappeared. Agricultural cooperation as it exists today is of recent origin, both in legal form and the cause which gave it birth. All these causes are far from being of the same nature, but all were determined by the exigencies of economic life. The cooperative credit system was caused by the need of a monetary system instead of the barter system, and the cooperative production and sale societies were due to the need for more intensive cultivation of the land and of profiting more and more by the improvements offered by technical science.

It must not be forgotten how much the agricultural crisis of the ten years, 1890-1899, contributed to favor the cooperative movement. These causes helped to spread the cooperative move-

ment over all Germany in a few decades and in 1900 there were about 24,000 societies, while in 1922 the number had increased to 50,172.

The first cooperative dairy societies were in the low plains of northern Germany, where farms existed with large numbers of



Large Light Colored Mountain Bull, Germany.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

dairy cattle. Creameries were established later in Posen, Silicia, Brandenburg, and in Hanover. In South Germany only a few creameries were founded. As early as 1884, 172 cooperative dairies were operating, principally in northern Germany. In 1923 there were 3,467 creameries and dairies.

Other societies were established for the improvement of cattle by using better breeding methods.

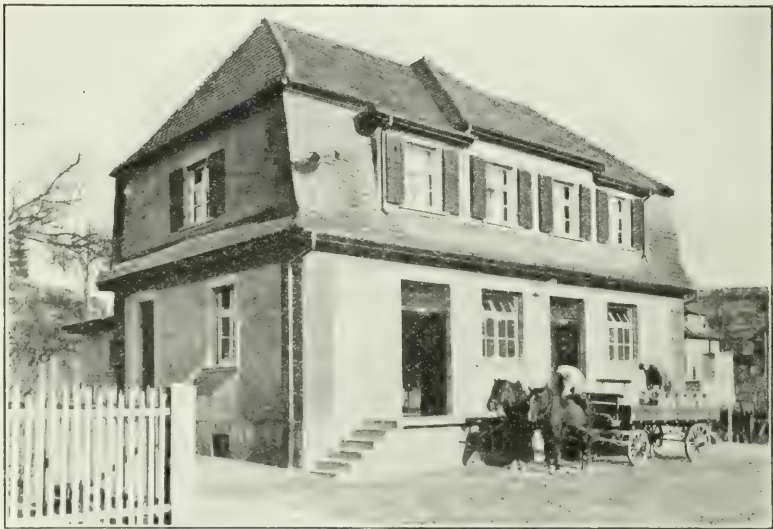
A general federation of the societies was founded July 6, 1883, and was at first called the Federation of German Agricultural Co-operative Societies, but 20 years later it took the title Imperial Federation of the German Agricultural Cooperative Societies. In 1889, after the promulgation of the act of May 1, a new era opened for cooperative societies and a large number were rapidly

formed. On June 1, 1910, there were 18,962 cooperative societies in this federation.

In 1905 the two branches of cooperatives united, then consisting of 19,000 affiliated societies and one and three-fourth million members. In 1908 these cooperative dairies received 2,224,500,000 kilos of milk (4,904,000,000 pounds).

About two-thirds of the cooperatives belonged to the national federation.

COW-TESTING ASSOCIATIONS—The first cow-testing association was founded in 1897. The number of these associations grew rapidly and in 1914 there were 792, as a result of the war, there were only 300 in 1920, but in 1922 the number had increased to 1,100 societies and 430,242 cows under test. Each of these associations has an average membership of from 11 to 18



Milk Cooling Station in Factory at Osterburken, Germany.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

members, mostly in Northern Germany. Some of these societies have increased both the average milk yield and average butterfat content of their cows, while others have increased either the milk yield or the butterfat content of the milk. A few of the societies

showed an actual decrease in fat content of milk but an increased yield of milk.

The German people have developed their cattle until the cattle meet their requirements. The mountain cattle are well suited to the mountains and the heavy cattle are suited to the low lands. The cow-testing associations have caused the culling of the herds more closely than previously and have put the German dairy industry on a new basis with new life. This was the condition just prior to the war (1914). Since the war, however, the attention to cow-testing associations accounts for the large increase in number of societies and indicates a confidence in that system of developing the production of milk.

IMPROVEMENT AND DEVELOPMENT—Dairying in Germany is not so well developed as in some of the neighboring countries. The number of milk cows has always been too few for the number of people, which has caused a light consumption of milk, butter, and cheese for many years. Gradually the number of cows has increased until there is a goodly supply of fresh milk for the cities and towns, but the butter supply is not sufficient from



Milk Cooling Room in Factory at Koningshofen, Germany.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

domestic production. For this reason also there are practically no German types of cheese of world reputation. The milk which could have been made into cheese was always needed for market milk and for the manufacture of butter; hence, the cheeses were chiefly a skim milk or part skim product. The Munster cheese is one of the best cheeses made in the country.

In 1884 the first cooperative creamery was established and in 1919 there were 1,722 in all Germany. At the beginning of this period the progress was slow but as the factory system and cow-testing associations became known the development was really ex-



Milk Wagons, Berlin.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

ceptional. Better methods of breeding and feeding were adopted. Herdbooks were open for registry and a commission had the selection of bulls for the public. The cow-testing records showed an increase of 1,000 pounds gain in milk yield in 10 years.

HOUSING AND FEEDING—In the low lands, as a general rule, cattle are confined in stables the year round, the land being considered too valuable for grazing, except for a few weeks on the stubble fields after the crops have been harvested. In the mountain districts alone the cattle are pastured throughout the summer.

Stable feeding is practiced only in winter. Small farmers let their cows feed along the wayside in the mornings and evenings.

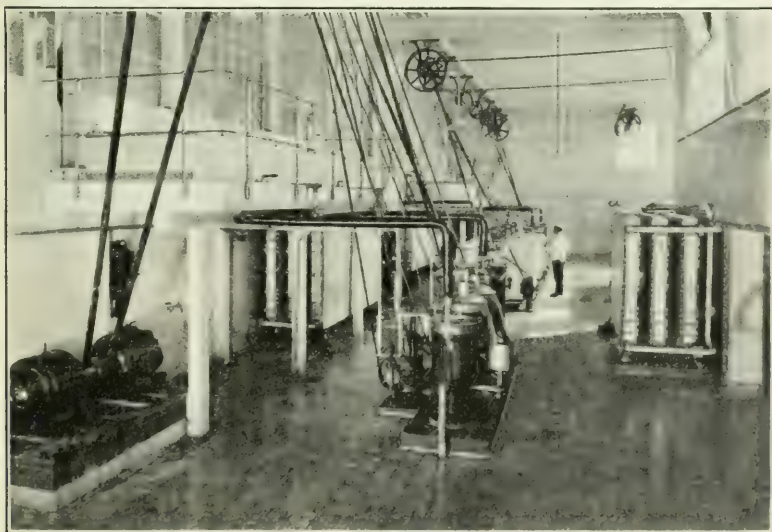
One style of stables is built of bricks and thatched with straw, and is very healthful and warm in winter.

Newborn calves are not allowed to suckle the cows but are fed on milk for about 3 weeks. After that time they are fed butter-milk and bread soup. It has been demonstrated that calves fed in this manner progress faster than if fed on milk for a long time.

Grass is fed in summer (soiling system). In the winter hay, grain, beans bruised, oil cake, and different sorts of turnips are fed.

Germany has a goodly number of grasses, as red clover, white clover, timothy, rye grass, esparsette, lucerne, and serradella. In addition Indian corn drilled to be cut green, and lupines, vetches, and fodder beans are also largely planted. Turnips, beets, and potatoes are used for cattle feed.

The thousands of breweries and distilleries furnish brewers' grain and potato mash from the distilleries, while the sugar factories sell to dairymen great quantities of beet pulp. The offal of starch factories is also used as feed for dairy cows.



Milk Separators in German Butter Factory.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

EXTENT OF THE INDUSTRY — Before the year 1914 55 per cent of the total production of milk was consumed as milk and cream, leaving 45 per cent for manufacture and the rearing of calves, pigs, and chickens. The production and distribution of market milk is, therefore, one of the largest branches of the industry in Germany and many of the larger cities have finely equipped dairies where the milk is pasteurized by the latest pasteurizing units and the milk delivered in bottles in accordance with the best standards of sanitation.

During the war the production of milk and dairy products decreased on account of lack of feed for the cattle so that, according



Cheese Curing Room in Germany.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

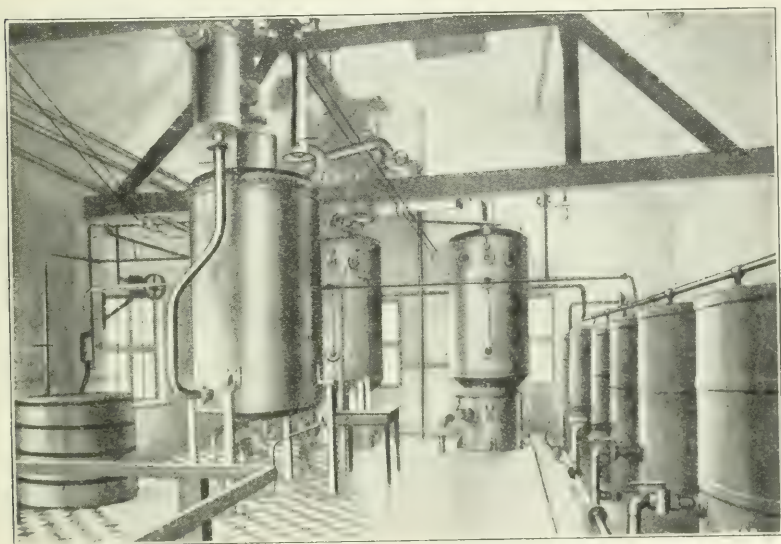
to Starling, the children of all classes throughout the country show signs of defective nourishment and rickets.

The production of butter for the period 1909 to 1913 was 881,840,000 pounds, and of cheese there were manufactured 590,000,000 pounds of all kinds, according to official estimates; however, this may have included cottage cheese, which is usually not counted together with the cured cheeses. This may account in part for the very large figure of estimated cheese production which at

that time was the largest for all the countries in the world. It is claimed during the war this production of butter and cheese was cut in about half as the total milk production was decreased about the same proportion.

There are very few official figures for Germany as a whole and such as are found are estimates which do not agree very well.

The consumption of cheese in Germany averages nearly 10 pounds per person in normal times. In southern Germany soft cheeses are the more common, such as Limburger, hand, cottage. Neufchatel, imitation Camembert, and Brie. Munster is also made



Milk Sugar Plant at Obergischhof, Germany.

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

in that section. All kinds of cheese are consumed the same way, that is, in the form of sandwiches, on or with bread, and generally in connection with beer. Cheese is also used in the preparation of macaroni, but is seldom served at regular meals.

MARKET—From 1900 to 1913 there were heavy exports of condensed milk and whole milk. However, the imports of butter and cheese greatly exceeded the exports. The imports of butter reached 123 million pounds in 1911, with an export of less than a million pounds. Cheese imports reached 57 million pounds

in 1913, with an export of 1.6 million pounds. The condensed milk was the exception, as the exports exceeded the imports. The exports were more than 10 million pounds a year from 1909 to 1913, while the imports were less than 100,000 pounds, except for the one year 1913, when the imports were 114,000 pounds. Since the war the imports of all dairy products have far exceeded the exports, and have exceeded pre-war records.

SCIENCE—Germany has contributed largely to the application of science to the dairy industry. In 1876 Dr. W. Fleischmann annexed a milk station to his school of milk in Mecklenburg, and organized the first milk institute. Hufe of Berlin made researches in milk fermentation, and Soxhlet at Munich in milk chemistry. Martiny wrote on milk and its products. Lefeldt invented dairy equipment and made a centrifuge and cream separator. The published works of Fleischmann and Soxhlet are extensive and are in use by dairymen throughout the world.

Other prominent scientists who have contributed to the dairy industry in various ways are: Wilh. Helm, Dr. Frz. Jos. Herz, Dr. W. Kirchner, C. C. Peterson, W. Shafer, Dr. M. Schodt, Als. Verleger, Paul Parey, Dr. Feser, Dr. Rahn, and Dr. Fehling.

SHEEP AND GOATS—Sheep and goats have been numerous in Germany for many years. In 1892 there were more than 3 million goats in the country, while the number of sheep exceeds that of the goats. These animals are used for their milk, mutton, and skins, but the milk production is a very important industry in itself. The sheep's milk is usually made into cheese while the milk of goats is used for human consumption in liquid form.

The quantity of goats' and sheep's milk available for human consumption prior to the war was estimated by Kuczynski and Zyntz at 2,800,000,000 pounds and 230,000,000 pounds respectively. These estimates were based on the number of goats over one year of age (2,608,874) and ewes (3,320,645) according to the census of December, 1912, and using an average of 1,100 pounds as the yield of goats and 70 pounds as the yield of the ewes. (The production for the goats is too high as it requires an exceptional goat to reach 1,100 pounds, and the yield of the sheep is too low, as other countries estimate about 70 quarts as an average.)

The estimate of cheese from sheep milk assumes that practically all the sheep milk was made into cheese at 15 pounds per 100 pounds of milk. That gives as the quantity of sheep-milk cheese 34,500,000 pounds, or about 10 pounds, for each sheep giving milk.

In the absence of official estimates or the production figures from other sources these estimates are used to give an idea of the importance of sheep and goats in Germany as a part of the dairy industry.

CHRONOLOGICAL EVENTS

YEAR

- 13th Century Dutch introduced cattle into Baltic Province (Pomerania).
- 1788 First steam engine in operation.
- 1835 First railroad in Germany.
- 1860 Industries increased by Civil War in the United States.
- 1867 Stettgast issued a private herdbook.
- 1871 Benno Martiny wrote one volume on milk and its products.
- 1871 Milch-Zeitung first published.
- 1873 Financial crisis in industries.
- 1874 Lefeldt exhibited his centrifuge at an exposition in Bremen.
- 1876 Fleischmann annexed a milk station to his school.
- 1880 Survey made to ascertain the number of bulls in Saxony.
- 1880 Herdbook society founded.
- 1883 Federation of agricultural co-operative societies, later called "Imperial Federation of German Agricultural Co-operative Societies."
- 1884 Hufe of Berlin began researches on fermentation of milk.
- 1886-1905 Foot-and-mouth disease prevalent. Affected $1\frac{1}{2}$ million head in 1892, and again prevalent in 1899.
- 1889 Soxhlet at Munich studying milk chemistry.
- 1890-1899 Agricultural crisis.
- 1897 First cow-testing association organized in northern Germany.
- 1905 Two branches of co-operatives united.
- 1914-18 World War. Great decrease in number of cattle. Number of goats increased.
- 1924 Reconstructed finance on gold basis, and all industries took on new life. Dairying gaining very fast.

GERMANY—NUMBER OF COWS AND TOTAL CATTLE AND GOATS
(Statistisches Jahrbuch)

Year	Cows	Total Cattle	Goats
1883	9,087,293	15,786,764	.....
1892	9,946,255	17,555,834	3,091,508
1900	10,458,631	18,939,692	3,266,997
1907	10,966,998	20,630,544	3,330,000
1912	10,944,283	20,182,021	3,410,396
1913	11,320,460	20,994,344	3,548,384
1914	11,316,457	21,817,375	3,538,414
1915	10,970,009	20,316,948	3,438,296
1916	.....	20,338,950	.....
1917	.....	19,649,575	.....
1918	.....	17,226,855	.....
1919	7,796,931	16,317,329	4,564,210
1920	8,865,632	16,789,844	.....
1921	8,222,753	16,839,559	.....
1922	8,202,477	15,109,000	4,140,199
1923	7,595,568	15,321,000	4,658,607
1924	8,796,032	17,296,280	4,350,633
1925	.....	.....	.....

NOTE: In 1923 the number of cows was 49.9 per cent of the total cattle.

YIELD OF MILK AND PRODUCTION OF DAIRY PRODUCTS
(Food conditions in Germany, E. H. Starling, 1919)

Year	Average Milk Yield	Total Milk Produced	Butter Produced	Cheese Produced
	Pounds	Pounds	Pounds	Pounds
1909-13	4,988	53,096,615,000	881,840,000	590,832,000
1916	4,257	36,894,000,000	.....	.....
1917	3,543	31,654,500,000	.....	.....
1918	3,070	26,961,000,000	529,104,000	.....
1919	2,016	.....	.....	.....
1922 ¹	3,050	24,050,000,000	530,000,000	.....

¹ Milk and its uses. International Institute of Agriculture, Rome, includes the milk of goats.

IMPORTS OF DAIRY PRODUCTS
(Auswärtiger Handel Deutschlands)
(Institute of Agriculture, Rome)

Year	Butter	Cheese	Condensed Milk	Whole Milk
	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds
1897	19,937	.....	3	20,744
1900	34,647	36,689	4	33,154
1910	92,816	46,011	59	82,054
1911	123,619	45,954	53	92,154
1912	122,472	47,277	57	.....
1913	119,576	57,903	114	5,603
1914	.....	.....	1	5,515
1920 ¹	17,227	50,345	9,181	.....
1921	3,350	59,973	9,814	42,086
1922	2,368	51,984	9,294	21,146
1923	2,903	24,930	8,872	19,256
1924	117,896	96,702	26,753	110,327
1925	.....	.....	.....	.....

¹ Present boundaries.

EXPORTS OF DAIRY PRODUCTS
(Same as Imports)

Year	Butter	Cheese	Condensed Milk	Whole Milk
	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds
1897	7,915	.....	6,239	11,891
1900	5,565	2,563	6,105	17,255
1910	399	1,858	10,132	15,745
1911	555	2,179	10,402	19,114
1912	482	1,812	10,256	25,934
1913	602	1,603	18,203	27,447
1914	.....	.....	.....	.....
1920 ¹	429	173	525	3,197
1921	203	1,023	2,890	6,745
1922	619	2,235	1,022	12,114
1923	147	636	582	2,173
1924	59	1,239	570	406
1925	.....	.....	.....	.....

¹ Present boundaries.

NUMBER OF CO-OPERATIVE FACTORIES IN GERMANY
(Bulletin of Economical Intelligence, Rome)

Year	Number	Year	Number
1884	172	1915	3,594
1890	839	1916	3,601
1895	1,222	1917	3,601
1900	1,917	1918	3,593
1905	2,832	1923	3,467
1910	3,325	1924	.....
1914	3,572	1925	.....

QUANTITY OF MILK SUPPLIED CO-OPERATIVE DAIRIES
(International Review of Agric. Economics, Yr. XI., No. 11, Rome)

Year	Gallons Supplied	Year	Gallons Supplied
1914	595,358,000	1917	407,417,000
1915	614,540,000	1918	370,865,000
1916	480,823,000	....	.....

SWITZERLAND.

The herdman lives and sleeps with his cattle from spring to autumn. Naturally pure-blooded cattle, curried and brushed daily, trained to lead and be handled, always cared for, and never beaten or abused, have in the course of generations become perfectly domesticated.

NATURAL CONDITIONS — Switzerland is situated in the Alps Mountains, high above the sea level. It has an area of 15,976 square miles and a population of 234.8 per square mile. The surface is largely very rugged, 28.4 per cent being unproductive.



Typical Herd Scene, Switzerland.

Courtesy of Mr. Shoup.

Of the total, tillable land the pasture lands occupy 35.8 per cent, forests 29 per cent and fruits, crops, and gardens the remaining 35.2 per cent.

In order to overcome the handicaps of this mountainous country the farmers of necessity use the most intensified form of farm-

ing possible, and practically every square yard of land is utilized. The winters are severe, while the summers are liable to sudden, cold winds at any time. The climate, therefore, is suited to the preservation of milk and its products, but requires a breed of rugged cattle. The scarcity of agricultural products can be noted from the fact that prior to the World War the Swiss harvests of cereals were sufficient to satisfy the needs of the country for from 45 to 50 days only. At the close of the war the harvests had been increased sufficiently to supply the people from 60 to 90 days. Thus, it will be seen that there is great need for imports of bread grains and that little grain can be spared for cattle unless it is imported.

In the mountain districts of the country the farms and villages are situated chiefly in the valleys. The farms are uninclosed by either hedges or fences and as the number of cattle kept on the farms is high in proportion to the acreage it is almost, if not entirely, possible to fertilize the entire area each year with manure. All liquid manure is used as well as the more solid.

Cattle—EARLY HISTORY—Cattle were a part of man's possessions in what is now known as Switzerland as early as 4,000 B. C., according to Troltch. Instruments for the manufacture of cheese have been dug up with the remains of the "lake dwellers," which represents a period before any written human history. The inhabitants kept herds of cattle, goats, sheep, and swine. The cattle were used as beasts of burden. Cows were milked and butter and cheese made. Even a crude dash churn was used at that early age.

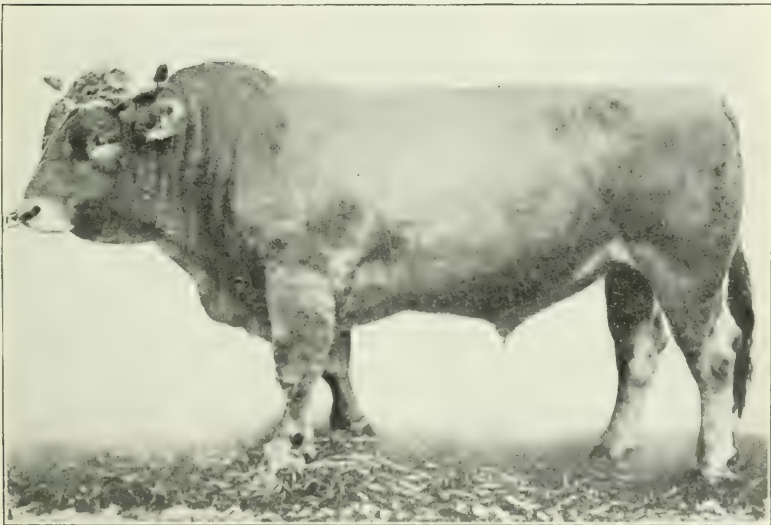
The aboriginal cattle, says Werner, were black with white spots. About the beginning of the 5th century the Allemanni went from south Germany to eastern Switzerland carrying with them the red Celtic breed of cattle. When the Burgundians settled in western Switzerland, in 443 A. D., another breed was introduced and some authorities suggest that the Brown Swiss (Schwyz) of today are the result of careful selection of that type; however, this does not agree with the statement that the Brown Swiss are similar to the cattle which were in existence when the "lake dwellers" inhabited that section. It is further asserted that the cattle of Switzerland came from southern Siberia at an early age. Notwithstanding these differences as to origin of the breeds

of cattle in Switzerland it is definitely proved that the Brown-Swiss cattle are one of the oldest breeds of dairy cattle.

BREEDS—Two distinct breeds of dairy cattle have originated and been fully developed in Switzerland, the Brown Swiss and the Simmenthal. These breeds are noted for their milk production and adaptability to live in a high, rugged country. Both breeds are especially good rustlers where vegetation is scarce.

These two breeds have not always been in full possession of the land as numerous attempts have been made to introduce the Shorthorn and Friesian cattle and to cross them with the Brown Swiss and Simmenthal. The attempts have practically failed and the two original breeds are now the dependence of the dairy industry in that country.

Which of these two breeds is better adapted to the use of the

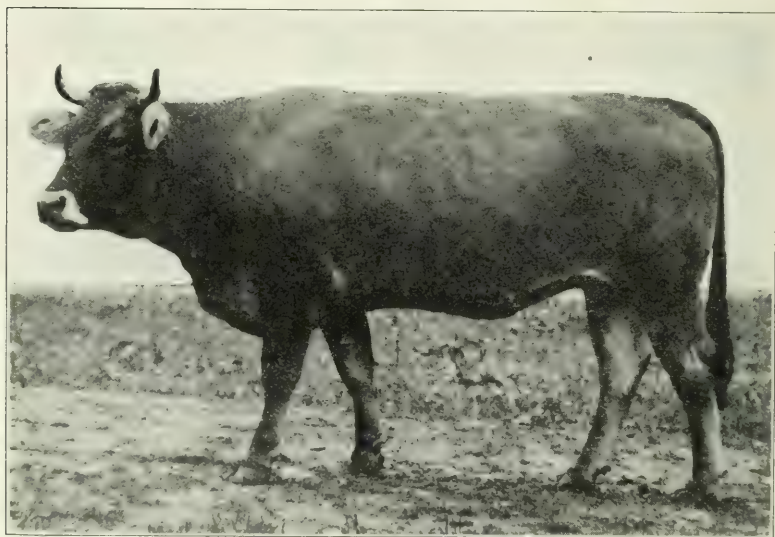


Brown Swiss, Switzerland.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

Swiss farmers is a disputed question; however, both breeds are still used after several centuries and are highly appreciated for their dairy qualities. It is, however, an assured fact that the lighter Brown-Swiss cattle are better adapted to the higher and rougher ground, while the heavier spotted cattle are better for the valleys.

BROWN SWISS—The Brown Swiss, taking its name from the Canton Schwyz, are alike adapted for milk, beef, and draught. At present it is found principally in the Cantons of Uri, Schwyz, Glarus, Zug, two Appenzell, St. Galle, and Grisons. The color is a mouse brown with silver points, although some are silver gray. These cattle will probably rank in the second class as to size among dairy breeds. They are substantial, well proportioned, with very straight, broad backs, heavy legs and neck, giving a general appearance of coarseness. Bulls and cows are alike docile and easily managed. Mature cows weigh from 1,200 to 1,400 and bulls may



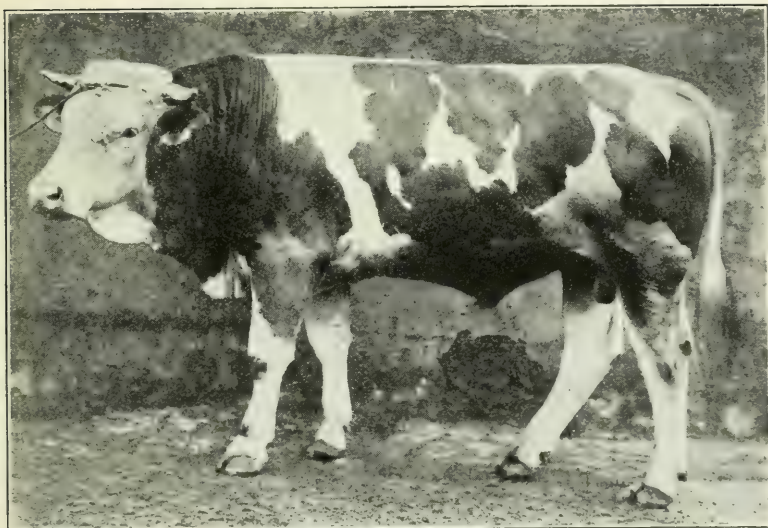
Brown Swiss, Switzerland.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

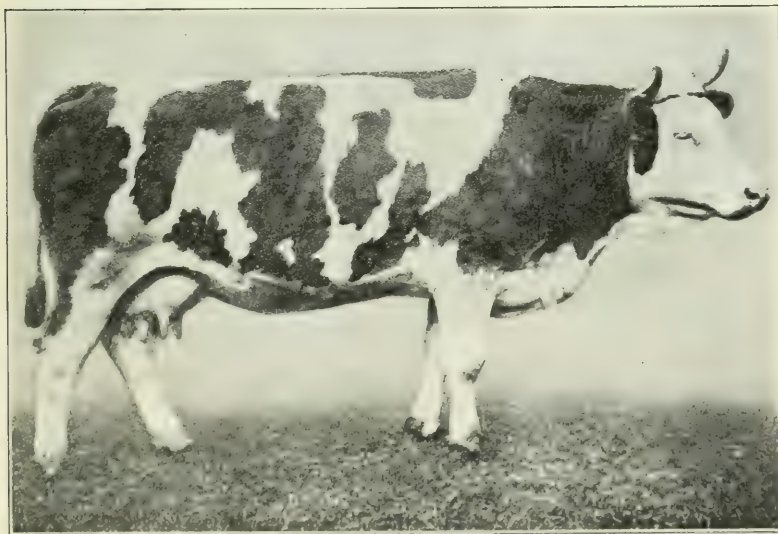
weigh up to 1,800 pounds or more. These cattle are very active and are extremely hardy, being of necessity good mountain climbers.

The milk yield of this breed averages, in Switzerland, 6,000 pounds or more a year, with an average fat content of 3.6 per cent. Some records are much higher.

The cattle of LeValais are similar to the Brown Swiss but are said to be a separate breed.



Simmenthal Bull, Berne, Switzerland.



Baron Nr. 343 VZG Weissenbach, Switzerland.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

SIMMENTHAL—The origin of this breed is somewhat in doubt but it is thought to have come from the Netherlands; however, it was developed in the Valleys of Simme and Saane, hence the name Simmenthal, also called Saanenthal breed. It is found in the central and western part of the country. The predomi-



**Prof. A. Peter, Director of Dairy School
at Rutti-Zillikofen, Switzerland.**

nating color is white with red spots, although some have black or yellow spots. The cows weigh from 1,200 to 1,700 pounds and are among the largest of all dairy breeds. The fattening quality of this breed is extraordinary and the oxen make excellent draught animals. The use of cattle as draught animals is considered an economy in Switzerland. Even the cows are used for light work. This work does not seem to affect the milk production, as the cows have practically no other exercise as they are in barns most of the year.

Large numbers of this breed are to be found in Germany, Austria, and Hungary, where they are called "Fleckvich," meaning speckled or spotted. This breed has been exported to many lands but in no country do they have the importance they maintain in their homeland.

The annual yield of milk of this breed is stated to be between 6,000 and 7,000 pounds, with a fat content of from 3.5 to 4.0 per cent.

Roughly speaking the cattle of Switzerland are divided into three-fifths Simmenthal and two-fifths Brown Swiss, but there is also a sprinkling of other dairy breeds in the country.

The per cent of dairy cows to the total cattle shows the importance attached to the dairy cow. The figures are: 1866—56 per cent, 1886—55, 1901—55, 1916—53, 1921—52.3 per cent.

For many years Switzerland has been a large exporter of dairy



Haying in the Emmenthal Region of Switzerland.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

cattle, the average for the five years just preceding the World War being 18,834 a year, while in 1916 it was 61,171 head but in 1917 it dropped to 19,808. The World War did not affect a decrease in the number of cattle, especially cows, as at the present time their number is greater than ever before, although they have experienced a severe outbreak of foot-and-mouth disease since the war.

DEVELOPMENT—Just before the great development which took place about the year 1880, the farmers lived in villages or

on their farms, but in either case the dwelling and stable were under one roof. Great, roomy, and homely but picturesque, those structures were, house and barns covered with the same steep, projecting roof of red tiles. The part where the family lived was usually made of wood with outside stairs. The second story over the sheds and stable was for the storing of hay and was generally made of rough logs. The stable was made to close very tightly and was generally constructed of solid masonry plastered within and without, allowing little light or ventilation. In such stables the cows of the lowlands (valleys) were kept the year round—the Swiss farmer never forgets that warmth and quiet save feed for his cows. The principal feed is hay and grass, to which may be added some roots and a little grain or other concentrates, mostly imported.

The lighter cattle in some sections are driven in May or June to the high valleys and pastures, where they remain until the end of the summer. They are milked and the milk is made into cheese to be brought down when it is cured. The men and cattle have adequate shelter from sudden storms in the mountains in "chalets" made of logs and chinked with clay or moss and sometimes has a fireplace. The cows are pastured only on fair days and are fed grass in bad weather and at night. The herdmen, one to each 12 or 15 cows, actually live and sleep with the cattle all the summer. Naturally, the cattle are very docile.

The old order was: Dry feed for winter; calving in February and March; grass feed early in spring to start milk flow; movement up the mountains for grass and herbs; returning to stables in fall.

LATER METHODS AND DEVELOPMENT — Dairy farming in Switzerland is successful chiefly on account of the abundance of grass which the cultivated lands provide for stall feeding (soiling) in summer and for hay in winter. The altitude of 5,000 feet appears to be the limit of useful herbage for cattle pasturing. The stall feeding system is used with great efficiency in the valleys and plains. The farmers avail themselves of all the advantages of the system, namely, the absence of fences, hedges, roads, and paths around and through the fields, leaving more land for farming; above all, the cattle are not driven or exercised more than is necessary, which would require more feed.

Switzerland has advanced in dairying very rapidly in the last 25 years. After the invention of the cream separator, the use of mechanical refrigeration, and the development of the factory system, the Swiss added to them its present cooperative methods of organization and then improved their barns by the constructing of better-lighted and better ventilated buildings. The feeding of grass and hay was supplemented with roots, cereals, and cottonseed meal and cake, especially in the winter.

Dr. Nicholas Gerber in 1888 invented the fat tester¹ which takes a prominent place in most European countries. In 1900 Dr. Gerber was instrumental in the inauguration in Zurich of a milk-delivery system similar to those of the United States in which the delivery is carried on by wagons and all the milk is distributed to



Dairy School at Moudon, Switzerland.

the homes in glass bottles. The milk-distributing dairy is well equipped, the milk pasteurized and patrons protected in every possible way by hygienic methods.

The larger farmers do not use the mountain herds as in former years but graze the valleys and use stall feeding (soiling).

¹See United Kingdom.

Dairymen of Switzerland are divided into two classes, one class produces milk for consumption in cities as milk or cream, and for condensing, and the other class produces milk principally for the manufacture of cheese.

The cows are milked twice daily and the milk is promptly cooled and placed by the road for the collector. As there are many small producers the collection system is a great saving of time.



Curing Room at Zillikofen.

Market milk production is an important part of the dairy industry, as more than one-half of the milk produced is consumed as milk or cream. Most of the large cities have the milk distributed from wagons from a central milk plant, but many dog carts are still in use in a large part of the country.

CHEESE—The principal products are cheese, condensed milk, and butter. Cheese and condensed milk have been produced in large quantities for years. As early as 1810 the exports of cheese amounted to 1,322,760 pounds, in 1860 it had increased to 16,180,000 pounds, and in 1923 it was 39,045,000 pounds.

Condensed milk has been an export ever since 1860 and in 1923 it had reached a total of 55,827,000 pounds.

As the butter production does not equal the demands of the country, large quantities are imported each year. Much of the imported butter is unsalted and is intended for cooking purposes. The imports of butter come principally from the Netherlands, Denmark, and France. The average production of butter for the years 1911 to 1913 was 34,833,000 pounds, and of cheese 165,-125,000 pounds, and condensed milk, sweetened and unsweetened, 94,798,000 pounds. The production in 1923 was—butter, 28,-700,000, cheese, 125,800,000, condensed milk, 71,000,000 pounds—and in 1924 it was for butter 26,680,000 pounds and for cheese 141,420,000 pounds.

A number of kinds of cheeses have been made in Switzerland but the Emmenthal, Gruyere, and Glaris (sap sago) are the principal ones at the present time (1925). The following is a list of the kinds made:

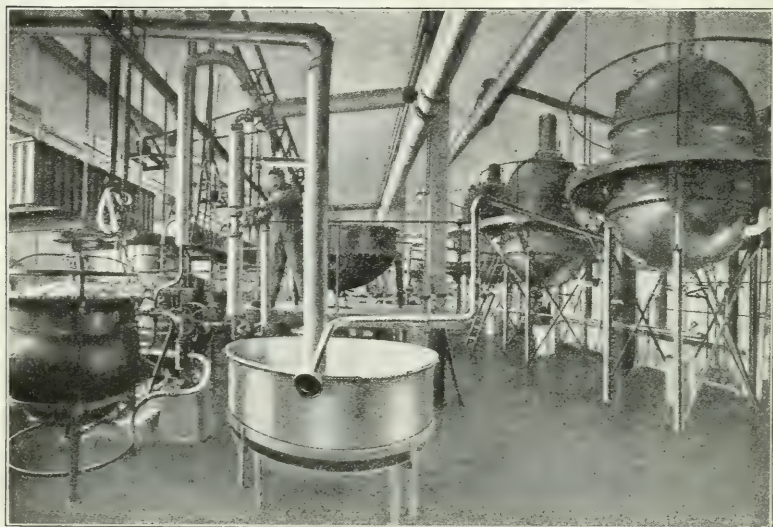
Emmenthal (whole milk).	Urseren (skim).
Gruyere (three-quarters to full).	Bellelay.
Spalen.	Vacherin.
Glaris (sapsago) green. (Glaren)	Schabzieger (whey).
(Krauterkase).	Battelmat.
Saanen (skim).	Magerkase (skim).
Formaggio della peglia.	Grana.

Cheese was rudely made until about the year 1800, when artificial fodders were introduced and stall feeding began. This added economy gave a new incentive to the production of cheese, and by the improvement of the quality of the cheese the consumption was increased and new markets developed. This has been the order in other countries—increased quality followed by increased consumption. By the year 1880 the making of cheese passed from the rude state to that of as fine an art as the making of the noted Swiss watches.

Gruyere cheese is supposed to have originated in the provinces of Jura and Doubs, France, about the year 1750. It was first called "grey erzer" in Freiburg. It is made in both the mountains and the valleys of Switzerland and resembles Emmenthal in most respects but is sometimes a partly skimmed cheese.

Notwithstanding the long time that cheese has been made in the country, somewhat more than 20 centuries, it was not until

after 1800 that the product became of international importance in trade. The peasants have made cheese in the mountains for many years but no associations were formed until 1830. From



Condensery at Hochdorf, Switzerland.

that date Switzerland became a cheesemaking country. (In the 14th and 15th centuries the exportation of cheese was prohibited by law.)

CONDENSED MILK—The Nestles-Anglo-Swiss Milk Condensing Company was begun by Mr. M. C. A. Page, an American, in 1866 at Cham, has a number of factories in other countries, and is one of the largest producers of condensed milk in the world. In 1913, the company, with headquarters at Cham, controlled and operated 7 factories in Switzerland, 5 in England, 2 in Bavaria, 1 in Austria, 3 in Norway, 3 in Australia, and 1 in Spain, with an average annual output valued at \$10,000,000. Their factories are equipped with the best machinery and the product is shipped to all parts of the world. In 1875, Henri Nestle, of Vevey, produced an infant food and in 1878 began the manufacture of condensed milk. In 1905 the Nestles and Anglo-Swiss companies were united, forming the Nestles-Anglo-Swiss Milk Condensing Company.

The milk-chocolate industry of Switzerland is also important, as it utilizes large quantities of milk in a production of chocolate which is becoming larger each year. The chocolate factories clarify the milk and pasteurize it before using it in the manufacture of chocolate.

COOPERATION—Agricultural cooperation is as old as agriculture. In the Middle Ages cooperative societies were numerous and were for various agricultural purposes. True cooperation of the voluntary or modern type began only with the change from barter system to the money system.

The small farmers of Switzerland were obliged to cooperate to avoid failure in the economic struggle. The necessity for collective working made itself felt most in the handling of milk. Milk is one of the products which require immediate handling, and the necessity has been well understood in Switzerland for centuries.

Several of these cooperative societies date from the 16th and 17th centuries, but in the course of the 19th century an important change came in the aim of the Swiss agricultural class. Switzerland was becoming a country of manufacturing industries and its population was increasing rapidly. Transportation by rail had improved and it was possible to import grain at a comparatively low cost, and, further, there was an increasing demand for animal products. By the extension of the cultivation of clover it was possible to increase the number of cattle. This change made the products of the dairy greater than was needed by the inhabitants, and was a beginning of the expansion in dairying.

In 1918 the first cooperative cheesemaking society of the valley farmers was formed and was soon followed by others. The speed with which cooperative societies were formed is shown in the following table:

Date	Number Organized
Before 1850	345
1850-1869	546
1870-1879	324
1880-1889	483
1890-1899	436
1900-1909	654
1910-1919	659
1920	12

Following the organization of cooperative societies came the federation of these societies. These federations were organized to get more power for the cooperatives and to counteract the effort of the buying organizations and the condenseries. The first "Federation of Cooperative Dairies and Cheese Factories of Northern Switzerland" was organized in 1904.

The purpose of the cooperation of these societies was different from commercial organizations, as cooperatives usually organize to get more members and more product while the commercial organizations cooperate for an increase in capital.

COOPERATIVE SOCIETIES—The cooperative associations are divided into two classes, according to the interests. A, associations of manufacturers and dealers, B, federations of milk producers.

A. ASSOCIATIONS OF MANUFACTURERS AND DEALERS—

Swiss Dairy Society. Founded in 1887 for the purpose of improving production and technique as well as sale of produce.

Dairy society of Latin Switzerland. Founded February, 1887.

Co-operative society of Swiss firms engaged in exportation of cheese. Founded 1917 in consequence of the war.

Federation of Swiss cheese exporters, constituted October, 1896.

Swiss dairy federation. Founded in 1907; present membership 350.

Free association of Swiss cheese marchants; constituted April, 1915.

Free association of producers and merchants of Appenzell cheese.

Federation of Swiss producers of soft cheese; founded January 29, 1917

Swiss butter union; constituted May, 1917.

Federation of cheese producers of the Canton of Vaud; founded in 1916.

Dairy society of the Canton of Friburg; constituted April, 1916.

Gruyere cheese association. Limited-liability company, at Bulle, founded May, 1916, and comprises 5 dairy and cheesemaking societies and federations of the district.

B. FEDERATIONS OF MILK PRODUCERS—

The object of these organizations is to protect the interests of producers and especially to insure a remunerative price for their milk.

Federation of co-operative dairy societies and co-operative cheesemaking societies of Canton Berne. Formed October, 1911. In 1918 it had 726 societies.

Thurgau federation of cheesemaking societies, headquarters at Weinfelden, founded in 1893, and now has 211 societies.

Federation of cooperative societies and cooperative cheesemaking societies in northeast Switzerland, headquarters at Winterthur; founded in 1904, and now has 568 societies.

Federation of co-operative cheesemaking societies of the Canton of St. Gall, headquarters at St. Gall; founded in 1907, and now has 130 societies.

Aargau federation of co-operative dairy societies and co-operative cheesemaking societies, headquarters at Brugg, founded in 1908, and now has 160 societies.

United Geneva Dairies, headquarters at Geneva; now has 53 societies.

Federation of dairies of Vaud and Friburg, headquarters at Donneloye, founded in 1907, and now has 275 societies.

Federation of co-operative societies for the utilization of milk of central Switzerland, headquarters at Lucerne; founded in 1907, and now has 301 societies.

Federation of milk producers of the cantons of St. Gall and Appenzell, headquarters at Rheineck, founded in 1907, and now has 25 societies.

Federation of co-operative dairy societies of the Cantons of Zug, Aargau, and Lucerne, headquarters at Zug, founded in 1906, and now has 23 societies.

Federation of co-operative dairy societies and co-operative cheesemaking societies of northwest Switzerland, headquarters at Basle, founded in 1905, and now has 234 societies.

Federation of milk producers of Morschach and its neighborhood, headquarters at Goldach, founded in 1907, and now has 4 societies.

Federation of co-operative societies of the Cantons of Vaud and Geneva. It now has 48 societies.

Federation of co-operative societies of Friburg Zone of the Bulle Mountains. It now has 121 societies.

Federation of milk producers of Rheintel-Appenzell. Now has 25 societies.

Federation of dairies of Jura and Appenzell, which now has 115 societies.

Agricultural dairy, Lucerne, founded in 1895, and now has 40 societies.

Syndicate of milk producers of Lausanne and its neighborhood, now having 39 societies.

Federation of dairies of the district of Leman, now having 63 societies.

Federation of the dairies of the Canton of Neuchâtel, headquarters at Cernier, now has 68 societies.

Federation of milk producers of Nidwalden, headquarters at Oberdorf, now has 8 societies.

Federation of milk producers of Obwalden, headquarters at Sarnen, now has 5 societies.

Federation of milk producers of the Canton of Appenzell, headquarters at Steinegg-Appenzell, now has 1 society.

Association of milk producers of the Canton of Ticino, headquarters at Bellinzona, now has 8 societies.

EXTENT OF DAIRYING—It is difficult to describe the development of dairying in Switzerland as it is among the oldest in Europe and the growth has been so constant and gradual that apparently there are no real prominent eras or decades.

The number of dairy cows has gained fairly regularly and averaged 4,000 per year increase ever since the year 1866. The



Federal Dairy at Leman.

goat is also used for the production of milk and the number of goats decreased from 375,000 in 1866 to 240,000 in 1923. The yield of milk per cow has increased also, hence the quantity of milk produced in the country is much larger than in 1866. The records of milk production are available only since the year 1911, when it was estimated as 4,445,000,000 pounds. The production of milk decreased during the World War but in 1923 it had regained most of the loss, and was 5,410,000,000 pounds, which was but a little lower than for the year 1914.

The production of butter has always been about equal to the domestic demands and there were practically no exports.

There has been a market for Emmenthal cheese extending far back into Swiss history, and from 1852 the records indicate that

the price of Emmenthal cheese has ranged from 48 to 93 francs for 50 kilograms (110 pounds). (The par value of a franc is 19.3 cents.)

The manufacture of dairy products was about at its highest in 1914. During that year the production of butter was 33,478,000 pounds and cheese production amounted to 174,825,000 pounds, while condensed milk was 121,253,000 pounds. The cheese production was greater for the year 1913, and butter ranged a little higher for two years after 1914.

Peter Cailler Kohler established a chocolate factory at Broc in 1897. The first factory was established in 1826 and in 1913 there were 14 factories, employing 6,700 people and manufacturing 66,000,000 pounds of chocolate valued at \$14,500,000.

The Swiss are just beginning (1925) to install ice cream plants, similar to those in the United States.



Dairy House, Rutti Dairy School, Switzerland.

The export of fresh milk was at its peak in 1915, when it amounted to 41,199,000 pounds, and the cheese export was at its highest in 1913, when it was 79,650,000 pounds, while the condensed milk exports were highest in 1914, registering 100,000,000 pounds.

Since the war the exports have not reached the former position. In 1924 the cheese exports were 43,775,000 pounds, and condensed milk 58,225,000.

Milking machines are being used by some large farmers almost exclusively although their introduction is not very general.

The progress of dairying is slow, definite, and substantial with cooperation as the central incentive. The war interrupted a fine prospect. When the war ended, the price of milk fell, wages stayed high, cattle-disease outbreak occurred, and a number of bad



Dairy School at Fribourg.

harvests followed. The collapse of the Swiss dairy industry was averted within one year under the direction of the Swiss Peasants' secretariat and with the combined aid of the State and the cheese-control organizations. By a systematic organization of the imports and exports it was possible to free the markets, open up new trade, and tide over the difficulty.

EDUCATIONAL—The schools of Switzerland owe their origin to the movement of progress in the dairy centers of Europe, from 1880 to 1885. The first schools have as an object the improvement in the raising of cereals and cattle development. For many years educational work pertaining to dairying and agriculture has

received much attention. The principal schools are at Freiburg, Rutti, Moudon, Perolles, and Sarnthal. Regular dairy courses are carried in these schools and the renowned scientific research in milk and its products have been of great service to dairying throughout the world.

Rural and itinerant schools are also maintained.

A few of the noted scientific and educational leaders of Switzerland are Dr. N. Gerber, F. Andregg, Mueller of Berne, Dr. Von Freudenreich, and Dr. Rud. Schatzmann, Prof. Peter, Mr. de Vevey, Mr. Badoux, Dr. Burriand, Dr. Laur, and Dr. Wyssmann.

CHRONOLOGICAL EVENTS

DATE

- 400 B. C. Cattle and dairying in Switzerland.
- 400 A. D. Allemanni carry cattle to eastern Switzerland.
- 443 Burgundians introduce cattle into western Switzerland.
- 1000 An innovation in ground cheese (Schabziger) began in Glaris.
- 13-1400 Cheese production was prominent, but exports prohibited.
- 15th century Cheese made under the name "Emmenthalerkase" also exported.
- 1622 Emmenthal cheese was made fat, half fat, and poor.
- 1800 Artificial fodders were introduced. Stall feeding began.
- 1800 Austria imported 10,000 centners (hundredweights) of cheese from Switzerland.
- 1830 Co-operation in cheesemaking began.
- 1857 Dr. Chr. Muller invented the lactometer and Marchand invented lacto-butyrometer.
- 1866 Mr. Page built the first condensery at Cham.
- 1875 Henri Nestle invented an infant food.
- 1879-80 Centrifuge invented.
- 1880 Dairy exhibit at Geneva.
- 1882 Churns used were usually barrel churns.
- 1884 Muller made Keipher.
- 1887 Swiss dairy society organized.
- 1887 Dr. Vevey organized milk school at Freiburg and edited a dairy paper.
- 1888 Dr. Nicholas Gerber invented his fat test.
- 1896 Federation of Swiss cheese exporters formed.
- 1900 First cow-testing association formed.
- 1900 Dr. Gerber began plans for market-milk system for large cities.
- 1907 Swiss dairy federation formed.
- 1911 Federation of co-operative dairies and cheese factories organized in Berne.
- 1914-18 World War decreased the number of cows and ruined markets.
- 1916 Gruyere cheese association formed.
- 1917 Swiss Butter Union formed.
- 1917 Federation of Swiss producers of soft cheese formed.
- 1918 First co-operative cheese factory of valley farmers formed.

NUMBER OF DAIRY COWS, TOTAL CATTLE, AND GOATS
(Statistisches Jahrbuch der Schweiz.)

Year	Dairy Cows	Total Cattle	Goats
1866	553,205	993,291	375,482
1876	592,413	1,035,856	396,001
1886	663,120	1,212,538	416,323
1896	688,052	1,306,696	415,817
1901	739,922	1,340,375	354,634
1908	785,950	1,498,144	362,117
1911	796,909	1,443,483	341,296
1916	848,011	1,615,893	358,093
1918	785,547	1,520,165	356,455
1919	738,896	1,005,000	349,794
1920	729,999	1,382,116	333,852
1921	746,591	1,425,000	329,000
1922	760,000	.....	240,000
1923	780,000	.....	240,000

PRODUCTION OF MILK, ESTIMATED OFFICIALLY
(Statistische Jahrbuch der Schweiz)
(Thousand Pounds—000 Omitted)

Year	Cows' Milk	Goats' Milk	Total Milk
1911	5,224,902	209,437	5,445,362
1914	5,886,282	220,460	6,106,742
1917	4,585,568	220,460	4,806,028
1918	3,968,280	220,460	4,188,740
1920	.....	.....	4,453,292
1921	.....	.....	4,820,137
1922	.....	.....	5,238,130
1923	.....	.....	5,410,000

DAIRY PRODUCTS MADE IN FACTORIES
(Statistische Jahrbuch der Schweiz)
(Thousand Pounds—000 Omitted)

Year	Cheese	Butter	Condensed Milk
1911	144,401	31,526	99,207
1914	174,825	33,478	121,253
1915	127,426	36,596	110,230
1916	110,891	37,037	99,207
1917	71,429	30,864	66,138
1918	63,052	28,880	55,115
1920	84,877	20,944	46,297
1921	102,007	26,896	66,138
1922	122,027	28,660	48,501
1923 ¹	125,800	28,700	71,000
1924 ¹	141,420	26,680	.....

¹ Preliminary.

PER CAPITA CONSUMPTION OF DAIRY PRODUCTS
(Statistische Jahrbuch der Schweiz)

Year	Cheese	Butter	Condensed Milk	Whole Milk
	Pounds	Pounds	Pounds	Gallons
1911	22.0	11.5	13.2	64.3
1912	28.9	11.2	8.8	64.3
1913	28.2	12.6	...	67.2
1914	26.4	12.1	22.0	67.4
1915	15.0	11.0	15.4	67.7
1916	17.4	9.9	13.2	71.8
1917	14.8	8.2	11.0	67.5
1918	16.1	7.5	....	51.3
1922	20.0	11.1	....	67.0

IMPORTS OF DAIRY PRODUCTS
(Swiss Commerce Reports)
(Thousand Pounds—000 Omitted)

Year	Fresh Milk	Butter	Cheese	Condensed Milk
1885	246	2,622	2,855	....
1890	12,996	3,557	3,183	....
1900	16,038	4,249	5,172	....
1910	20,111	11,063	6,309	124
1915	15,510	5,700	3,410	717
1918	7,189	54	87	2
1920	14,150	18,140	4,368	6,168
1921	27,393	15,994	1,894	1,432
1922	18,814	15,088	1,792	5
1923	21,496	14,684	2,543	177
1924	17,775	19,993	4,163	120

EXPORTS OF DAIRY PRODUCTS
(Swiss Commerce Reports)
(Thousand Pounds—000 Omitted)

Year	Fresh Milk	Butter	Cheese	Condensed Milk
1900	8,959	218	60,265	62,387
1910	31,063	32	69,392	69,587
1915	41,199	74	74,775	96,300
1918	20,739	0	2,680	43,820
1920	10,356	3	3,202	46,513
1921	7,857	10	10,596	46,825
1922	14,907	8	46,152	45,474
1923	18,591	20	39,046	55,827
1924	76,972	252	43,775	58,225

ITALY.

NATURAL CONDITIONS—The Apennines, a mountain range, divide Italy into three parts. These mountains, practically in its center, extend about three-fourths of the length of the country from south to north, separating it into eastern and western, then turn to the western boundary, leaving the great plains of the valley of the Po River extending entirely across the northern part of the country, which is the principal grazing and agricultural land of Italy. The eastern and western slopes of the mountains furnish pasture for the maintenance of flocks and herds and are fairly well suited for dairying.

The following general description was given by Consul Noyes in 1887:

"In Italy, with prolonged heat in summer and dry, cold winters, luxuriant pastures in hill and valley are rare and keep their freshness but a moment. Mountain ranges and spurs occupy much of the surface, land is divided into the smallest parcels, horses are few and too precious to be employed in cultivation; intensive agriculture is little known, and it can be established only by the work of years. Until then the race of cattle must be adapted to all uses; principally labor, and subsidiarily to slaughter and dairy production; and even then it is doubtful whether the climate and vegetation could offer a congenial home for the ultrarefined and developed animals of more favored regions. Attempts to naturalize them, made with all the precautions and liberality of scientific experiments, have not so far succeeded."

This statement is really very critical as indicated by the progress since that date, but the following quotation for the same period shows that some sections of Italy had already realized the true value of dairying.

"The Provinces of Mantova, Parma, and Emilie are highly advanced in agriculture, due largely to the extended use of chemical fertilizer, and further improved with the manure of milk cattle. In Piedmont and Lombardy these same improved practices date back many years and where dairying is greatest there is found progress also in the irrigation of fields."

The Province of Venetia is seemingly suited to dairying but the heat of summer is a serious drawback, for unless irrigation furnishes water the danger of drought will be distracting and dairying will be limited. During autumn, winter, and spring the cows in this region give about one-half of the average of the summer.

In the irrigated regions of the northern provinces grass is cut 8 months of the year and in the winter-meadows it is cut 10 months (Soiling).

EARLY HISTORY—For more than 20 centuries cattle have been numerous in Italy. The Greeks referred to it as a country of cattle. Oxen were considered invaluable and to kill one was considered as serious an offense as to kill a man. White oxen were said to have been used in sacrifices at times. The Romans were known to have gone to Switzerland, as the milk of the Swiss herds was considered a cure for tuberculosis. Butter and cheese were known even before the first century, but the principal use of butter was thought to be as a medicine; at least its use was rather an incident than a practice.

Pliny states that "butter constitutes a privileged food which distinguishes the rich from the poor." Some of the writings of that age by Varrone and Columella (first century) show that the manufacture and nutritive value of dairy products were well understood. Varrone says: "The most nutritious cheeses are those of cows' milk." In regard to cheesemaking he says, "The making of raisin cheese takes place from the Pleiads of the spring to the Pleiads of the summer. In the spring the animals are milked in the morning and other seasons they are milked at noon." (This appears to indicate one milking a day—therefore a moderate yield.)

Columella gives a detailed statement of the making of cheese, which is instructive even today:

"After the coagulation has occurred it is important to drain out the serum (whey) at the first moment by separating it from the coagulated matter, when the cheese is somewhat strengthened the farmers secure weights for pressing out the serum. The cheese after being taken from the baskets is placed in a shady place on the cleanest tables and it is sprinkled with powdered salt so that all the liquid acid which it contains may dry. This operation is performed for 9 days in succession. With such precaution the cheese does not become filled with eyes."

From Columella's description of the points of merit of bulls, cows, and draft oxen it is certain that much attention was given to selection of breeding animals. The breeding of cattle was influenced by the cattle brought from Epirus, in Greece, which had been noted for its fine cattle as far back as 300 years B. C. (Morse.)

It is said that the inbreeding that has followed through these centuries with the native cattle has been without deterioration of the stock.

Italian authorities state that the invaders from the north appropriated the arts, culture, and the industries of Italy, including butter and cheesemaking, and at the dawn of the Middle Ages the invaders introduced them into France, Germany, and the Scandinavian countries.

MIDDLE AGES — The milk industry during the invasions had been relegated to the Alpine passes and restricted to the milk of sheep and goats. About the year 1100, after the wars had raged for about 7 centuries, a period of peace followed, and there was a return to agriculture, pasture fields were restored, and irrigation was much extended. About that time cheesemaking in the mountains decreased slowly, the herds of cows took the place of sheep, and pasture ground gave up its place to the stable. There was such an increase in the production of forage, of milk, and products of milk that in 1200 the Po Valley was considered the principal cheesemaking section of Europe. At that time Grana and Gorgonzola cheese were brought into prominence in Lombardy and Emilia.

The height of progress came in 1500 but owing to the competition of the nations of western Europe (Netherlands, France, England, Germany, and Switzerland), Italy lost the domination of the dairy industry which she had gained and held up to the last half of that century.

CATTLE—The breeds of cattle are numerous but not well defined. Some of the types are but branches or grades of breeds carrying the name of the region where they were found. The Valteline cattle are well known and are simply a cross between Brown Swiss and the Piedmont. Some of the breeds are considered as native since they have been for centuries in the same region.

The lack of proper breeding and care together with the use of the cattle for work have restricted the dairy qualities of practically all the breeds. In the effort toward developing dairy qualities lies the hope of the industry, and most of the work is yet to be accomplished.

It must be remembered that Italy was overrun by armies for several centuries and the cattle of the country carried off or destroyed and other cattle brought in continually. For that reason little trace of the original breeds is found. Since the government has become more stable all the principal breeds of dairy cattle of England, Netherlands, France, and Switzerland have been used in attempts to improve the native stock, that is stock found in the land. Some of the old stock are very fine dairy cattle and a number of the crosses give good promise of developing into dairy breeds.



Chianina Heifer, Two Years Old (Silver White).

Courtesy of Bureau of Agric. Economics, U. S. Dept. of Agric.

In Italy as in most other countries the cattle near the border are generally crossed with the better types of foreign cattle. Near the northern border the Swiss and French breeds are found in large numbers and crosses are also numerous. Some of the crosses have been segregated for many years and are now practically distinct breeds. Many of the attempts at crossing the native cattle with the dairy breeds of other countries have failed and the cattle more or less have reverted to the original type.

Some of the principal breeds are given herewith, together with a few points of description or qualities:

The principal breeds of Friuli, Venetia, are 5 in number, Old Red Friuli, New Pied Red, the Grey-Brown, Red Carpathian, and Podolian.

THE OLD RED FRIULI breed which was formerly found throughout Friuli, northeastern Venetia, is now seen only in former Austrian parts. The remainder of the country is occupied by new breeds. This old breed is thought by Werner to be a hybrid of the Red Celtic and Steppe cattle. The color is maize yellow and greyish red in all shades to dark red. It is an excellent draft animal. The cows also are used for work and yield about $1\frac{1}{2}$ gallons of milk daily at the height of lactation. The cattle are thrifty and live on coarse grasses. No attention is paid to the breeding of these cattle.

NEW PIED RED FRIULI BREED, which is probably of Bergundian origin, is now largely mixed with the Brown-Swiss and Simmenthal breeds. These cattle fatten well and the cows give from 550 to 685 gallons of milk which has a fat content of 3.5 per cent. The cows are worked in the fields.

The GREY-BROWN BREED, of the mountainous regions of Venetia, are somewhat larger than the Brown-Swiss, which they resemble. They are suited to all purposes.

The RED CARPATHIAN breed of upper Friuli is not so large as the other breeds and gives only about 550 gallons of milk a year.

POLODIAN BREED (southern Russian origin). This breed is very large and the bulls weigh at maturity from 1,500 to 2,000 pounds. They are used largely for draft purposes. Very little tuberculosis is found in this province (Latium). The color of the adults is blue gray. Bulls are discarded as dangerous after becoming 7 years old. First calves are never kept but sent to slaughter, and cows are not called cows until they have calved the second time. The milk of this breed is rich, having an average of $6\frac{1}{2}$ per cent fat and 6.9 per cent of casein. This breed is very tall and the oxen walk as fast as horses, making them valuable for work. This breed is also found in Hungary and Rumania. The very large horns and the stateliness of the carriage of this breed of cattle are noticeable. The blood of this breed is found in many

of the breeds of Europe and its hardiness, freedom from disease, and size are its most valuable characteristics.

The VALTELINE (Piedmont) breed is simply a cross between the Piedmont breed and the Brown Swiss. The yield of milk is from 16 to 18 quarts a day.

WATER BUFFALO (same as found in India, southern China, etc.) A description as given in an extract from a consular report in 1887, is as follows: (See India and China).

Color: Black or reddish black.

Labor: They are used for farm work.

Meat: Authorities differ; some say it is good, others say it is not.

Housing: Not housed or tied. In bad weather they are allowed in a shed.

Feed: Mostly wild grasses of the marshes, but at times are given hay.

Breeding: No method used. Cows calve in autumn. Crossing with Brown Swiss not successful.

The water buffaloes are found principally in the marshy districts of Latium, making use of the marsh land on which no other animal could live and which can not be cultivated. In that stretch of marshes the buffaloes give high returns, as the inferior forage suffices for the animals and they require no other feed, while they furnish very rich milk, can be used for any kind of agricultural work, and finally can be sent to the butcher. The idea that buffaloes give very little profit has caused them to be neglected.

Full-grown buffaloes weigh 1,100 pounds or more. They are, therefore, very good animals for meat production. The meat, although darker in color than that of oxen and cows and of coarser grain, is just as wholesome, some say. Two breeds are found in Italy: March and Pocolo.

One herd only is permitted at Paludi Pontine and this herd is used mostly for opening of the drains in the swampy section. The buffaloes do not suffer from staying in the water; hence they are used to clear the canals as follows: The canals become choked with vegetation and must be cleared often. A herd of buffaloes is driven into the canals to cover its width so that their hoofs may uproot the vegetation as they feed. One of the tenders goes in a small canoe in front and the other behind the herd to keep them in place. The work of their hoofs is superior to that of instruments for clearing the canals.

Buffalo calves are reared exclusively on milk for the first 2 months and partly on milk until they are 8 months old. The second period is necessary as the buffalo cows will not give down their milk unless they are under the illusion that they are suckling their calves. The calves are allowed to start sucking then the man taps the calf on the head, driving it back, and finishing the milking himself, when the calf is again turned with the mother. The method of rearing buffaloes in Campagna is similar to that of rearing cattle. As a rule they are kept until they are 12 or 16 years old and then fattened for slaughter. The water buffalo is not so popular as previously. One reason is that the buffalo scoops out holes into which water gathers and mosquitoes breed, causing fever.

Buffalo milk has only a limited importance in the Roman Campagna, where the animal is raised. The milk is easily recognized by its peculiar odor of musk. Some of it is made into soft, white butter although it is generally made into cheese. The following cheeses are made from buffalo milk: Provature, mozzarella, marzolina, provola, uova di bufala (buffalo eggs), abote. These cheeses are heavy, solid, sweetish, white, and consumed within the district.

The milk yield averages about 6 quarts per day.

The production of cheese from buffalo milk is estimated at 1,850,000 a year.

The buffalo is wild and suspicious, but obedient to the orders of the tender (bufalaro) who is the only person it does obey. They are stronger than oxen. In Latium they are yoked and are well suited to the heavy loads and the rough roads.

In 1908 the quantity of buffalo cheese manufactured was estimated at one million pounds, and the total number of buffaloes was 19,366.

Breeds of Cattle in Italy

Name	Origin	Color	Uses	Location
Piedmontest (Carmagnolo)	Immemorial	Gray-brown	Beef and work	Piedmont
Reggiana (Parmense)	Immemorial	Red	Work, beef milk	Emilia
Pugliese	Hungarian	White	Work and beef	Venetia
Chianina (Marsh)	Pondolian	Silver white	Milk and beef	Latium. Rome

Name	Origin	Color	Uses	Location
Maranana	....	Gray and white and speckled	Work	Tuscany
(Tiberian)	black			
Tyrolese	....	....	Milk 3,000 lbs.	Venetia
Bellunese	....	....	Milk 2,850 lbs.	Venetia
Montanina	....	....	Milk	Venetia
Valtelline	B. Swiss & Piedmont	Gray-red	Milk and work	Piedmont
Friuli	Red Celtic	Gray-red	Milk, beef	Venetia
New Pied Friuli	Burgundian	Pied	Milk	Venetia
Red Carpathian	Hungarian	Red	Milk	Venetia
Water Buffalo	Latium (India)	Black & red- dish black		Latium, Rome
Montovana	....	....	....	Tuscany
Svizzera	....	Black	Beef, milk	Pisa
Swiss Sardinian Cross		....	Milk	Sardini

MODERN DEVELOPMENT OF COOPERATIVE ORGANIZATIONS
—In 1870 Italy was little more than a collection of disjointed and backward states. She had to liquidate the cost of an expensive war and to begin the work of reconstruction. Her railroads were either foreign owned or foreign controlled. Her industries were insignificant. Her ports were inadequate and her agriculture primitive. From 1870 to 1880 her economic progress was scarcely appreciable. France, her usual customer, now cut her off with a tariff, and German trade increased so fast that Italy's lost trade could not be regained. Her wealth in animals was small, which reacted upon the other industries.

Dairying, from the years 1500 to 1800, was apparently in a state of torpor and did not awaken in reality until 1870, when the Franco-German War created exceptional demands for animals and dairy products. The Province of Lombardy immediately took advantage of this opportunity and in consequence dairying in the Po River Valley made rapid progress. It is important to note that the war, the awakening of dairying in northern Italy, and the beginning of cooperative dairying, all centered around the year 1870.

Although cooperative associations had existed in northern Italy ever since the 14th and 15th centuries, the first cooperative creamery (butter factory) was organized January 8, 1872, at Forno

di Canale, Venetia, in the valley of Agordo. It was an imitation of the French "Fruiteries" and of the Swiss "chalets." These associations were instances of spontaneous forms of cooperatives arising out of the necessity of putting milk to a commercial use in mountain districts where the farms are very small and where union is indispensable if the production is to be profitable. After the first cooperatives were founded they gradually spread throughout the northern mountainous regions, thence to the plains and to the south. The total number in 1915 was 1,129, principally in the northern provinces.

The department of agriculture, which had existed but a short time, put on fairs in 1872 for the "social dairies." These social dairies (cooperatives) were directly affected by these fairs and their numbers increased, more than a score being organized the first year.

The first National Cheesemakers' Exposition was held in 1877 and the following year the first congress of directors of dairies was held at Milan. Thus the cooperative dairies, generally cheese factories, were started and they in turn gave dairying a great move forward in that country. By the year 1880 the cooperative factories were in the preponderance in that region, and it has remained the principal dairy section.

The next special development was about the year 1884 when the many small factories in the valleys of the Alps and the plains began to change from independent to cooperative societies. Many of them became cooperative in name but with very loose methods in the sale of their products. To correct this the minister of agriculture planned the forming of very large cooperatives to make cheese for export. These also were poorly organized, causing trouble and losses; however, later organizations profited by their mistakes and proper methods of organization and operation were established in that region.

At first there were three kinds of cooperatives, so called: 1. A rented factory worked in turn by the members and the product sold by each member; 2. An association which hired a cheesemaker; 3. An association where the members deliver their milk and where the product is sold by the association.

In 1912 there were 1,075 cooperative dairy associations in northern Italy with 14,000 members, and the milk delivered amounted to 49,000 tons (metric) while in southern Italy and

islands there were only 10 of these societies. The cooperative factories are well equipped. The milk is received once or twice a day, sampled, tested, weighed, and made at once into cheese. This cheese, Romano, originally made from sheep's milk, is now wholly made of cows' milk and is generally exported to America while the butter is marketed by large commercial firms. Some of the associations have a veterinarian who inspects the stables and "sets out" any cows not in good health, also rendering such advice and help as is possible. Some of the members of the cooperatives have pledged to deliver their milk for 30 years, and others to deliver milk during the term of the lease to the land occupied.

The largest cooperative dairy factory is that at Saresina, organized February, 1900, in the province of Cremona, Lombardy. It handles an average of 88,000 pounds of milk daily, and the output of butter is 3,500 pounds. It began making sheep cheese in 1911, sterilized and condensed milk in 1912, and began to export cheese in 1913, while in 1915 it began to supply the large cities with milk.

BREEDING ASSOCIATIONS—During the period from 1905 to 1912 about 133 breeding associations were founded. They were of two kinds; civil associations without share capital, and cooperative associations with share capital.

Professor Zappa stated in 1914, that, "The Italian breeds of cattle had undergone a great improvement recently due to feeding, and progress in methods of breeding and rearing. The development is shown in the increased live weight, early maturity, and larger milk yield. But there is still no complete description of Italian breeds and varieties. Almost every region has its own variety and in some sections there are numerous varieties."

FEDERATION OF COOPERATIVES — After the cooperatives had become well established the dairymen saw the need for a federation and a number were founded. Some of the first to organize were:

The federation of cooperative dairies of Agordo, Venetia, with 44 affiliating dairies.

The federation of Bergamo dairies, Lombardy, to which 21 dairies were affiliated.

The federation of dairies of Reggio Emilia, with 29 affiliated factories.

The federation of the districts of Lomello and Norvara, Piedmont.

The Bergamo Union of cooperative dairies.

To these must be added some cooperative associations which pack and sell cheese, cooperative societies for the sale of milk and butter to cities, and livestock-improvement syndicates.

The livestock syndicates, of which there are several kinds, range from the simplest to the most complex, such as are found in Switzerland and Germany. Some associations restrict their work to cooperative breeding in seven of the provinces, and each year the members select a commission to purchase and oversee the breeding of livestock. The most complex organizations look after the entire locality for breeding of purebred stock, care for the pastures, the prevention of disease, promoting of shows, fairs, and the insurance of stock.

These associations may be classed as what is usually known in other countries as bull associations and cow-testing associations. The first cow-testing association was founded in 1908.

CONSORTIUMS—Consortiums were a kind of federation or association with the purpose of promoting agriculture, dairying, or for the satisfying of any special need of the people. They first took up agriculture and later were prominent in getting contracts with cooperative dairies for the delivery of milk to cities. By this method they served both the cities and the dairies.

CONSORTIUMS OF GENOA FOR THE SALE OF MILK—This cooperative agency was organized in 1900 for the purpose of improving agriculture and the agricultural classes in general. This consortium started to solve the question of milk supply in the large cities when the need of organization of the milk trade in accordance with the requirements of hygienic and domestic economy was most urgently felt.

An accurate inquiry had shown that Genoa consumed daily more than 44,000 quarts of milk (increased to 77,000 in 1914), and that 87 per cent of it was skim milk. (Population, 235,000.) This caused the association to plan the selling of whole milk and a beginning was made with the hospitals in 1905. It then urged

the members of the contributing dairies to devote themselves to dairying. Soon the supply of milk was increased and the more progressive farmers formed themselves into a society for the purpose of offering better guarantees of supplies and getting better contracts from the consortium and for a longer period. The supply of milk was so perfect that the hospitals renewed their contracts and other institutions followed.

The consortium has added many of the most up-to-date improvements to their distributing plants, such as refrigerating rooms, chemical laboratory, expert chemists, and improvements in delivery system. Eighteen depots are in the most populous parts of the city and fully satisfy the requirements of the population.

The agricultural consortium of Genoa not only sells milk but places on sale humanized (modified) milk for children and invalids, also yoghurt, genuine olive oil, pure cream butter, and eggs, obtaining in the course of a few years a large custom and playing an important part in the provisioning of the city.

The following effects of cooperation were claimed by the year 1900:

1. Great increase in number of cows.
2. Increased yield of milk per cow.
3. Increased production of milk for the industry.
4. Increased exports of cheese from sheep's milk.
5. Establishment of a great number of co-operative creameries in northern Italy.
6. Installation of a number of condenseries.

The number of cattle in Italy increased about 30 per cent from 1881 to 1908.

EFFECTS OF WORLD WAR—During the latter part of the World War the Austrian armies invaded Venetia, which is one of the principal regions of dairying in the country. Only about 20 per cent of the original number of cattle were left in the province. Fortunately 85 or 90 per cent of them were cows. Private persons and the provincial zootechnical associations began to replace the stolen cattle of this region and more than 100,000 head were imported and distributed. The Brown-Swiss breed was selected for the mountainous districts, but no special breeds were chosen for the plains. The foot-and-mouth disease caused the death of more than 4,000 of these replacement cattle and many others were

removed on account of barrenness. By 1920 the number of cows was 60 per cent of the number in 1916, and the number of approved bulls was 90 per cent.

The effect of the war was also disastrous to the fine export trade of cheese. From 72,320,000 pounds exported in 1913 the quantity exported in 1918 was less than one million pounds, and in 1919 the imports were ten times as great as the exports.

METHODS OF HANDLING DAIRY STOCK—In the northern part of the country, where the principal dairy section lies, the cows are permanently stabled and grass is cut for their feed. (Cropping system). This apparently increases the yield of milk and is a great saving of feed. In the winter months oil cake and oil meal are added to the roughage.

Some large herds are still driven to the mountains during the summer months. When large cattle are driven to the mountains it is claimed that they soon become smaller and more nimble of foot to accommodate themselves to the conditions.

The purebred cattle of Switzerland and France are used to keep up the quality of their breeds.

In central Italy cattle breeding suffers much from the competition of sheep breeding, which accounts for the fact that there are fewer cattle in that part of the country.

Two methods of milk production are practiced: 1. Free grazing in the case of pure, local breeds; and 2. Stabling, in the case of imported breeds. The latter gives the larger quantity of milk but the imported breeds produce milk not so rich as the Roman cows. When the former system is adopted the herds always remain in the open and graze on the uncultivated fields and low, marshy meadows, or even in the woods, where the cows usually pass the winter after calving. Cattle can turn to good account the shrubs and coarse grass that sheep refuse to eat.

According to B. Bianchini, (1921):

"The method of breeding practiced is inbreeding and selection, and it is owing to this system that the Roman breed is the same today that it was 19 centuries ago. Long inbreeding has given rise to no deterioration of the stock."

This statement has special reference to the Podolian breed, which originated in Austria or farther east in southern Russia.

Cattle of Latium (Rome) seldom suffer from disease. Tuberculosis is almost unknown among them but they are much troubled with parasites.

The production of milk of the cattle of southern Italy leaves much to be desired, with an average lactation period of 7 months and a yield of about 5 quarts a day. The Roman cows give milk containing as much as 6.5 per cent of fat.

The method of milking the loose cows is unusual. The herd is divided into groups of 15 each with a cowherd over each group. Each cowherd milks his own cows. The cows are usually milked twice a day, 10 a. m. and 10 p. m. The animals are driven into the open space surrounded by walls. The cowherd calls each cow by name and when she comes close he throws a rope over her horns and pulls her head around to the left side and to the level of the forelegs where he makes it fast and then begins his milking.

Dairying is little developed in southern Italy. The raising of mutton is important and grapes and olives occupy the land. Butter and milk are used sparingly in the diet; however, cheese is used most extensively.

CHEESE—Italy has been noted for 2,000 years for the fine cheese produced. There are more than 40 kinds of cheese made. Some of these cheeses are known the world over and others are not known beyond the localities in which they are manufactured. It is to be noted that few if any of these cheeses are of recent origin.

About five-sixths of the milk produced in the country is made into cheese, butter and by-products, but most of it goes into cheese.

The export of cheese is large in normal times. Imports exceeded exports from 1871 to 1890 but since the latter date Italy has been an exporting nation, the peak quantity of cheese exported being in 1913, when 72,320,580 pounds were shipped out of the country. The largest export to one country is to the United States; and in this connection it may be said that the United States imports more cheese from Italy than from any other country.

The following is a list of some of the cheeses of Italy:

From cow's milk	From sheep milk	From mixed milk	From buffalo milk
Gorgonzola	Pecarino	Mixed cheese	Provolona
Caciovallo	Romano	Riovolo	Mozarella
Grana	Cotrone	Emmenthal, type	Uova di Bufala
Stracchino	Moliterno	Gruyere, type	Provature
Robiolo	Recorino	Permesan	Marzolina
Fresa	Sardo	Groiera	
Asino	Caciofiore	Millefiori	
Montasio	Incanestrato di	Parminiano	
Bra	Sicily		
Scarmoza			
Ricotta			

SHEEP AND GOATS—Sheep and goats have always held a prominent place in producing milk for consumption and for making into cheese. Sheep are numerous in Italy and generally yield an average of 70 gallons of milk annually while the goats give about half that quantity.

In southern Italy the milk of goats is considered much better than cow's or buffalo's milk as it is said to be more easily digested. Cheeses made from sheep milk are named above. Cheese from goats' milk is generally mixed with cows' milk and called "mixed cheese."

The sheep are most numerous in central and southern Italy and the rougher portions of the Apennine mountains, which are very suitable for sheep grazing.

Goats are found mostly in the southern Adriatic region and very little in any other parts.

The density of sheep population increases from north to south while cattle increases from south to north.

The amount of sheep cheese manufactured has been estimated as high as 55,000,000 pounds for a year, although it is admitted that 16,000,000 pounds is "mixed cheese" from sheep and goat milk.

CONSUMPTION—In general the consumption of dairy products is not large in the country as a whole. The northern part of the country consumes much larger quantities of these products than the central and southern. The consumption of cheese averages only 4.8 pounds per person while the butter was 2.5 pounds and whole milk was but 4.2 gallons.

In Tuscany practically all the milk produced is consumed as milk, and butter is produced in Lombardy and Emilia.

The large cities now have adequate facilities for the distribution of milk and the consumption, therefore, has increased in recent years. In 1902 Naples, with a population of 80,000 to 100,000, consumed only 22,000 quarts a day.

Cheese is used in every form, soft and hard, in soups, with macaroni, in pastries, and puddings. Cheese, fruit and olives are the chief subsistence in southern Italy and they are combined in many ways.

The Romano, or Roman cheese, is generally grated. The Caciovallo is used in northern Italy with spaghetti and the Roman is used in the same way in the south. Cheese is used in the preparation of meat. A steak is pounded and covered with lard and garlic, then Roman cheese, and rolled and roasted. Cheese is also eaten with bread or "out of hand," and is served at any meal of the day.

Ricotta cheese is a common article of diet and is delivered daily. It is eaten with cream and loaf sugar. This cheese is often made from goat's milk and is unsalted.

CHRONOLOGICAL EVENTS

YEAR

- 400 to 1100 Butter and cheese were made mostly from the milk of sheep and goats, as continuous wars for 7 centuries kept the industry in hiding in the mountains.
- 1100 Cows began to take the place of sheep and goats and agriculture began to develop rapidly.
- 1200 The Po Valley was the principal cheese section of Europe—Grana and Gorgonzola.
- 1500 Expansion of cheesemaking in England, Netherlands, France and Germany caused Italy to lose the domination of dairying.
- 1500-1800 Dairying in Italy in a state of torpor.
- 1870 Demands of Franco-German War revived cheesemaking in Italy.
- 1877 National Exposition of cheesemakers at Portici.
- 1878 First congress of directors of dairying at Milan.
- 1880 Co-operative dairies multiplying.
- 1884 Beginning of great development throughout the country.
- 1884 Co-operative creamery of Saligno, Venetia, organized.
- 1885 Co-operative creamery society of Fagogne, Venetia, organized.
- 1890 Increased manufacture of Emmenthal cheese in Lombardy and Piedmont.
- 1894 Cheesemaking greatly increased.
- 1895 Grana cheese manufactured, 42 million pounds.
- 1897 Creamery society of Grevellona, Lombardy, organized.
- 1898 Co-operative creamery of Gaggiano, Lombardy, organized.
- 1899 Co-operative creamery of Candio and Rabbion, Lombardy, organized.
- 1900 Co-operative consortium of Genoa organized for sale of milk.
- 1908 First cow-testing association organized.
- 1908 One million pounds of buffalo cheese made.
- 1914 World War began.
- 1914 Royal decree requiring calves to weigh 440 pounds when sent to slaughter.

NUMBER OF CATTLE, BUFFALOES, SHEEP, AND GOATS
(Official sources)

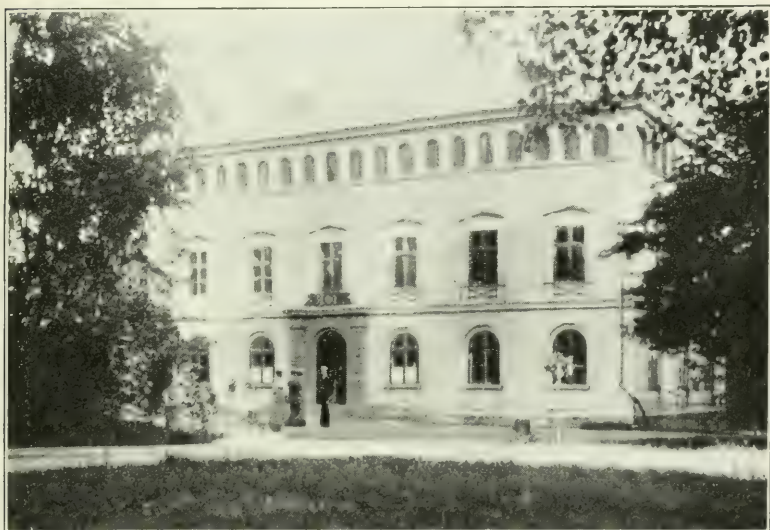
Year	Cattle	Buffaloes	Sheep	Goats
1881	4,772,000	11,000	8,596,000	2,016,000
1905	5,672,000			
1908	6,198,861	19,366	11,162,926	2,714,878
1914	6,646,000		13,824,000	
1918	6,239,741	24,026	11,753,910	3,082,558

IMPORTS AND EXPORTS OF DAIRY PRODUCTS

Year	Butter		Cheese		Condensed Milk	
	Imports	Exports	Imports	Exports	Imports	Exports
	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds
1871	288	2,213	12,553	3,887	.....	.....
1880	509	5,184	16,512	5,369	.....	.....
1890	706	6,710	17,059	12,559	.....	.....
1900	429	14,137	9,352	26,051	.....	.....
1910	345	8,295	14,761	57,516	575	6,615
1911	2,517	8,147	11,915	61,403	835	6,629
1912	899	8,843	10,069	67,505	955	7,184
1913	910	6,034	12,355	72,321	1,215	5,729
1914	194	9,310	9,838	66,004	1,112	9,999
1915	97	7,488	3,472	65,761	1,336	11,575
1916	136	792	252	39,323	1,093	6,907
1917	126	172	9	2,333	2,065	646
1918	73	109	746	938	7,415	157
1919	1,880	51	11,151	1,821	27,383	280
1920	3,104	96	5,893	2,790	1,633	405
1921	1,004	145	1,780	16,664	1,129	289
1922	2,964	1,683	15,571	32,057	664	1,043
1923	526	2,905	10,228	50,389	987	6,791
1924	1,002	6,436	4,223	71,906	855	13,559

SWEDEN.

NATURAL CONDITIONS—The area of Sweden is 172,876 square miles and the population in 1919 was 5,813,850. The cultivated area was divided in 1911 among 395,871 farmers with an average of 25 acres. Of the total area of land 52 per cent was



Chemical and Bacteriological Laboratory at Swedish Experiment Station.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

woods, only 3.2 per cent meadows, while 9 per cent was fields and gardens, the remaining 35.8 per cent being put to various uses.

In 1870 there were following agricultural pursuits 71.9 per cent of the people, in 1900 it had dropped to 53.7 per cent, and in 1910 down to 48.2 per cent.

Fodder and root crops are now (1924) very important and utilize several million acres.

The climate of Sweden is well adapted to dairying, being temperate and sufficiently cool for the keeping of milk. Snow lies on the ground from 47 to 190 days, from south to north, while

the average rainfall is 19.7 inches for the entire country but increasing from north to south.

The general surface of the country is rough, but practically all of Sweden slopes toward the southeast. The mountain range which divides Norway and Sweden runs the full length of the countries, Sweden being on the southeastern slope.

TENANCY—As the feudal system was never introduced into Sweden the small land holders had equal rights with the large owners. However, the State always had large parts of the land which was let out to hereditary tenants. From the Middle Ages to the 18th century Sweden was virtually a great crown estate occupied by nobles and peasants. In 1899 King Gustavus gave the peasants complete rights to argicultural lands.

CATTLE—"The history of the cattle of our country," says Sundberg, "presents a good many vicissitudes. The law of Uppland, A. D. 1296, describes Swedish cattle as being small, hornless, white, or white gray, often with dark spots. The Alpine breed in northern Sweden is so still, a race we have every reason to believe is the oldest in the country. In the 16th century King Gustav I imported breeds of Jutland and Holland cattle. Since then many importations have been made from the lowlands."

The several breeds of the country are, to a large extent, the result of imports of the 18th century from Denmark, Holland, and England and are: Ayrshire, Alpine, Shorthorn, and Gotland, the latter being of Swedish origin.

After the efforts of the 18th century to improve the cattle, not much was done until the establishment of the Swedish society for the improvement of cattle, red and white. Its object was to establish one breed of cattle of a milking strain. The herdbook of 1898 contained the names of 272 bulls and 3,827 cows.

No other stock have any importance in the production of milk in Sweden. Statistics were gathered every five years showing the number of dairy cows and the yield of milk from 1890 to 1913; since 1913 they have been gathered annually.

The average yield of milk for all cows in 1914 was 4,740 pounds, but the cow-testing associations showed an average of 5,750 pounds, one-tenth of all cows being in the cow-testing associations.

BREEDS OF CATTLE—There are five breeds of cattle which are given general consideration in Sweden, as follows:

The Fjall (north Swedish cattle)—The cows yield about 4,730 pounds of milk with a fat content of 3.8 per cent. Their live weight is about 770 pounds.

The Swedish red poll—Their weight and milk yield are about the same as the Fjall breed.

The Ayrshire in southern and central Sweden—The yield of milk is about 6,622 pounds a year, with an average fat content of 3.6 per cent, the live weight being 1,000 pounds.

The Red spotted Swedish in central Sweden—The milk yield is about 7,568 pounds a year, with a fat content of 3.8 per cent, while the average weight is about 1,100 pounds.

The Black spotted Swedish lowland in southern Sweden—The milk yield is said to be 8,514 pounds, and the fat content 3.3 per cent, while the average weight of the cow is 1,265 pounds.

There have been a number of incentives helping in the development of the dairy cattle of Sweden. These measures have been used, not singly, but in connection with each other and continuously. A few are as follows:

The establishments of herdbooks.

Recording associations, especially cow-testing associations.

Auctions of cattle.

Competition at breeding centers.

Veterinary and educational assistance.

REINDEER—The breeding of reindeer is very important. There are two kinds, the high-mountain and the forest reindeer. The high-mountain reindeer lives in the forest only in the winter, while the forest reindeer lives in the forest continuously.

DISEASES—The Ostertag, or German system, is used against tuberculosis, which provides for the elimination or segregation of animals which might spread the disease. The government uses also the Bang, or Denmark system, which is quite similar.

DEVELOPMENT—The following statement by E. Haglund is a brief survey of early conditions.

“The origin of the dairy industry in Sweden is extremely ancient and the breeding of cattle and the making of butter and cheese played an important part in the rural economy of the country up to about the end of the 16th century. Then a long period of stagnation and decadence set in, but in the middle of the 19th century agriculture underwent a transformation which determined a new

rise of the milk industry; after having aimed chiefly at the production of cereals, farmers began to take an ever-increasing interest in breeding, especially in connection with the production of milk. The manufacture of butter and cheese was transformed from a domestic pursuit into a veritable industry, which has continually gained in importance for the economy of the individual farmer as well as for that of the whole country."

The number of cows has increased until in 1914 there was one cow for every three persons and one cow for each $6\frac{1}{2}$ acres of cultivated land. The total production of milk in 1911 was 6,600,000,000 pounds, and about one-half of it was consumed as whole milk for human food. In 1890 1,115,784,000 pounds of milk were delivered to factories and in 1910 2,533,593,000 pounds.

The total milk production for the year 1920 was 8,800,000,000 pounds, estimated by the Central Bureau of Statistics, on the assumption of an average of 5,100 pounds per cow. The cow-testing associations for 1920 showed an average of 7,100 pounds. Practically half of the milk is used as milk for human food.

The first cow-testing association was established in 1898. In the year 1921-22 there were 507 associations having a total of 162,986 cows under test.

DAIRY PRODUCTS — Since 1890 the Swedish Yearbook (Statistik Årsbok) has given the pounds of milk delivered to creameries, the number of factories, and the quantities of butter and cheese manufactured each year. In 1890 the milk delivered to factories was more than a billion pounds. It increased up to the World War and amounted to 2,879,000,000 pounds, but the effect of the war caused a drop to 1,289,000,000 pounds. In 1922 the deliveries of milk were again up to 2,679,000,000. In addition there were 2,903,000 pounds of cream delivered to the same factories.

The quantity of butter made in 1890 was 35,479,510 pounds and increased up to 1914 when it reached 72,615,000 pounds, then dropped on account of the war to 23,400,000 pounds and since the war has again increased to 63,927,000 pounds in 1923.

The cheese made in 1890 was 14,538,412 pounds and in 1914 it was 28,869,237 pounds, and the latest figures for 1922 show 36,986,000 pounds made. This, however, is a slight reduction below the 1921 figure for cheese production.

The manufacture of concentrated milk is not important as there are but three factories, one makes condensed milk and the other two make milk powder.

TRADE—In 1865 the imports of butter into Sweden amounted to about 2,352,000 pounds while the exports were negligible. The imports increased up to 1885 when they were nearly six million pounds, but the exports of butter had jumped from almost nothing to 17,684,000 pounds in 1885. The imports dropped off rapidly from that date until the World War, while the exports ranged above 40 million pounds up to the war. During the war the imports again increased to about 15 million pounds a year, on account of the inability of dairymen to obtain feeds for their stock causing production to drop. However, the exports decreased accordingly.

The imports of cheese have always been greater than the exports but both have been small in quantity, only reaching $5\frac{1}{2}$ million pounds at most.

The imports and exports of condensed milk, including powder, have been up and down for years but not sufficiently constant to be an important line of business.

Sweden is reported to have had an export trade in butter in the 14th century.

The number of dairies (factories) in 1890 was 1,562, but in 1910 the number had decreased until there were only 1,416, yet at the same time the total amount of milk delivered to these factories had increased indicating some combining of factories. It is important to note that the number of cooperative factories did not decrease. In 1905 the number of cooperative factories was 470 and in 1910 it was 550.

There are four kinds of factories in Sweden. The kinds and numbers of each are shown for the year 1910:

	Number in operation
1. Cooperative dairies	550
2. Collecting dairies	475
3. Estate dairies	278
4. Estate collecting dairies	113
Total	1,416

The farm and factory butter produced in 1910 was 155,-232,188 pounds, of which 107,489,685 pounds were consumed within the country, being 19.5 pounds per person. In 1916, during the World War, the per capita consumption of butter was only 16.6 pounds. As a rule the factories are well managed, especially the butter factories. All milk is bought on the butter-fat basis as determined by the Lindstrom butyrometer. All cream is pasteurized before being made into butter.

CHEESE—Cheese is not exported in any great quantity, while the imports at times have exceeded a million pounds and reached five million in 1920. The four principal varieties of cheese are:

1. Swedish large eyed—resembling Emmenthal.
2. Norrland, whole-milk cheese, small eyed, very soft, (caraway or cloves).
3. Smaland shepherds' cheese—resembles Norrland but is never spiced and is more compact.
4. Mysost, (whey cheese).

BUTTER—THE RUNE BRAND—Mr. Bagge, Commissioner to the Swedish Government, gives an account of the purpose of the establishing of the "Rune brand:"

"Since the year 1905 the 'Rhune' brand has been registered as the mark of quality of Swedish butter. The example of Denmark has been followed in this respect though the 'Rune' brand has been exclusively applied to the best butter, while in Denmark the 'Lur' brand, until the year 1905, was used for the general output. The Swedish government was prompted in the action taken in 1905 to give assurance that Swedish butter would be sold in Great Britain as the product of Sweden, and to prevent the butter of other countries from being disposed of as Swedish; also purchases of the Swedish article bearing the name 'Rune' can rely on getting a first-class product. Another important reason is that an incentive will be given to creameries and factories to improve their general output of butter. It is not only a good quality that sanctions the use of the title 'Rune'; there are other stipulations which must be fulfilled—that the cream or the milk used for buttermaking shall be pasteurized to 176° F., that the moisture in the butter shall not exceed 16 per cent."

In maintaining the good name of Swedish dairy exports, the government employs a number of experts who travel throughout the country for this purpose; also the agricultural societies of each province have similar officials and experts engaged to supervise the testing of butter for export.

The production of "Rune" brand of butter in factories in 1923 amounted to 64,000,000 pounds. The moisture content

averaged 14.6 per cent. The total of all cheese made in 1923 was 38,505,000 pounds, according to consular reports. Besides the cheeses mentioned there are imitations of all well-known Dutch and English cheeses. The quantities of fat cheeses manufactured have increased but the others have decreased in their production.

CONSUMPTION—Sweden is one of the heaviest consumers of dairy products. The consumption of whole milk is practically one-half of the total production and the per capita consumption for 1914 was 69.7 gallons.

The consumption of butter was in 1917, a war period, 16.5 pounds. The percapita consumption of cheese in 1922 was 7 pounds. Cheese is used in Sweden mostly with bread or on bread and in the form of lunch sandwiches or otherwise in the luncheon. In the rural sections it is customary to have five meals or lunches a day. The breakfast in the morning comes first, then "coffee" about 10:30, then the noon meal, and in the afternoon about 3 p. m. another "coffee" is served and the full meal in the evening. In practically all the "coffee" periods cheese is served with bread and coffee; however, cheese may be served with all other meals but this is not generally done. (Sondergaard.)

DAIRY SCHOOLS—The following schools have special dairy courses:

Location	Kind
Alnarp, Lund	High school in agriculture and dairying.
Atvidaberg	Dairy school.
Fridhem	Agricultural school, short dairy course.
Hvilan	Short dairy course.
State dairy stations . . .	Actual work in large dairies.
Swedish machine-testing society . . .	Test all dairy machinery and publish reports.
Central Agricultural Experiment Station.	

CENTRIFUGAL CREAM SEPARATOR—For a number of years prior to the invention of the continuous cream separator there had been a great need of a rapid method of removing the cream from the milk. The old methods were slow, cumbersome, and did not remove all of the butterfat. The gravity method required much labor but also a great deal of space for the keeping of pans, crocks, etc., to hold the milk until the cream would raise. By the

gravity method the skim milk was always sour when the cream was removed and therefore unfit for the best feeding results.

Experiments were made as early as 1859 for the purpose of devising a centrifugal separator for skimming milk. Dr. Carl Gustaf Patrik De Laval, a young Swedish engineer, invented the



Dr. C. G. P. De Laval.

turbine engine, and while working in a large factory in Germany applied the centrifugal idea to the separation of substances from metal and then turned his attention to the separation of cream from milk. This was in 1877 while employed in Germany; however, the German managers refused to become interested in his latest invention and after a time he resigned and returned to Sweden in 1878. There he was able to get the proper encouragement and the first continuous separator was completed and soon thereafter it was given to the world. The invention therefore seems to have been from 1877 to 1879 but 1878 is usually accepted as the date.

The original separator had a hollow bowl, but in 1880 a number of steel discs were placed in the bowl to facilitate separation. The separator has been improved from time to time and several hundred patents have been taken out for the De Laval machine.

CHRONOLOGICAL EVENTS

YEAR

- 1300-1400 Claim some trade in butter.
- 1523-60 Dutch cattle imported by King Gustav I.
- 1743 English cattle imported by Jonas Alstromer.
- 1745-86 Cattle plague destroyed many herds.
- 1830 Alexis Noring imported cattle from England, Jutland, and Netherlands.
- 1830-40 Swiss cheesemaking introduced.
- 1840 Pan method of creaming used by R. Tormerhjelm.
- 1844 Government purchased breeding stock and established breeding farms raising Ayrshire, Pembroke, Voigtland, and Algau cattle.
- 1846 Dutch cheese began to be manufactured.
- 1860 Cheddar-cheese manufacture introduced by A. Nathorst.
- 1862 Dairy itinerant teachers began, continued to present time.
- 1861-70 Dairy companies began to organize—Swedes began to export dairy products.
- 1864 Ice method of cooling (Cooley system) produced by J. G. Swartz.
- 1872 Mechanical butterworkers first used in Sweden.
- 1878 Dr. G. De Laval invented his cream separator. Later improved by von Bechtolsheim (German) and Berrigan (U. S. A.).
- 1886 Swedish government established dairy agent in London, continued to date.
- 1888 Swedish dairy expert association formed.
- 1890 Dairy statistics published, beginning with that year.
- 1892 Central Sweden farmers founded society for red and white breed of cattle. Herdbook also founded.
- 1894 Testing of export butter began.
- 1895 Law enacted limiting responsibility of registered cooperative dairy associations.
- 1898 First cow-testing association founded.
- 1899 King Gustavus gave the peasants complete rights to lands.
- 1899 Martin Ekenberg invented milk drier, "Exsiccator."
- 1900 1,688 dairies in Sweden (factories).
- 1905 "Rune brand" established by law as trade-mark for Swedish produce.
- 1914-18 World war, shortage in cattle feeds.

NUMBER OF COWS AND TOTAL CATTLE
(Statistisk Årsbok and Statistik Tidskrift)

Year	Cows	Total Cattle	Year	Cows	Total Cattle
1865	1,185,556	1,924,354	1916	1,769,689	2,913,159
1870	1,231,477	1,965,900	1917	1,775,353	3,020,381
1880	1,409,236	2,227,757	1918	1,634,982	2,584,159
1890	1,578,927	2,399,491	1919	1,607,060	2,550,828
1900	1,764,819	2,582,555	1920	1,739,000	2,736,000
1910	1,861,219	2,747,526	1921	.....	.....
1911	1,837,035	2,689,609	1922	.....	.....
1913	1,841,991	2,720,741	1923	.....	.....
1914	1,845,989	2,761,000	1924	.....	.....
1915	1,841,508	2,883,884	....	.....	.....

WHOLE MILK AND CREAM DELIVERED TO DAIRIES (FACTORIES)
(Statistical Survey, Institute of Agriculture, Rome)

Year	Whole Milk	Cream	Year	Whole Milk	Cream
	1,000 Pounds	1,000 Pounds		1,000 Pounds	1,000 Pounds
1890	1,115,774	.....	1918	1,259,753	2,978
1900	1,856,892	.....	1919	1,531,189	2,948
1910	2,533,605	.....	1920	2,153,073	1,887
1913	2,808,937	7,050	1921	2,575,638	2,721
1914	2,730,807	3,739	1922	2,708,631	2,903
1915	2,351,428	2,705	1923	2,851,948	.....
1926	2,480,051	2,932	1924	.....	.....
1917	2,054,710	3,051	....	.....	.....

PRODUCTION OF MILK PRODUCTS IN THE DAIRIES
(Institute of Agriculture, Rome)

Year	Creamery Butter	Whey Butter	Fat Cheese	Semi-fat Cheese	Skim Cheese	Mysost
	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds
1910	72,617	...	...	...	...	...
1913	70,341	342	17,998	8,210	5,931	1,933
1914	70,341	252	16,951	4,902	7,016	1,363
1915	60,599	237	14,619	8,152	1,356	1,210
1916	62,269	268	17,243	10,078	1,185	1,493
1917	45,553	222	16,072	5,650	910	1,263
1918	23,456	208	8,356	3,116	326	2,404
1919	27,411	163	11,916	4,911	798	1,678
1920	42,913	255	19,990	10,543	1,367	1,176
1921	54,566	271	22,326	15,079	1,863	953
1922	61,025	293	20,653	13,480	1,782	1,071
1923	63,927	...	.....	38,505	.....	.....
1924	.....	...	.....	.....	.....	.....

IMPORTS AND EXPORTS OF BUTTER AND CHEESE
(Bidrag till Sveriges Officiäla)

Year	Butter		Cheese	
	Imports	Exports	Imports	Exports
	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds
1861-5 ¹	2,352	370	.....	.....
1871-5	3,348	6,955	.....	.....
1881-5	5,992	17,684	.....	.....
1890	3,920	33,163	430	317
1900	1,097	42,246	711	9
1910	205	47,949	712	52
1911	343	48,889	743	6
1912	273	46,818	1,279	12
1913	432	43,330	1,214	6
1914	189	41,941	765	69
1915	30	41,532	1,148	628
1916	61	28,704	286	1
1917	15,756	3	1,208	1
1918	11,426	3	424	...
1919	13,846	76	3,576	12
1920	16,917	53	5,398	397
1921	14,172	340	2,239	296
1922	5,691	3,043	1,992	336
1923	3,499	5,420	4,164	114
1924	1,232	11,832	2,206	266
1925	.....	20,750	.....	...

¹ Five Year Average.

NORWAY.

PHYSICAL CONDITIONS—Norway is practically a large plateau and the main part of the highlands is known as the "Great Waste." Mountains too high for trees occupy 70 per cent of the land area, while 23 per cent of the remainder is in forests, 4 per cent is in natural grass, and less than 3 per cent of the land is arable. Glacial action robbed Norway of a great amount of soil, and much of the remaining soil is too thin for cultivation. About all the good soil is found in the terraces of sand and clay about the fjords and on the plains arounds the lakes in the eastern districts. Small plains are found in the mouths of the Trondhjem valleys. Fully three-fifths of Norway consists of barren rocks. The land is so rough that it is with great difficulty that the people can have any commercial intercourse by land.

The inhabitable portion is literally along the coast, in the river valleys, and about the interior water courses. Industrial and commercial centers are on the seacoast or in the river valleys near the sources of the most important hydroelectric centers. Norway is just the opposite of Denmark in the matter of water power as the latter has none while the former can never hope to utilize any large portion of its water power.

The rainfall varies with the location but is usually from 12 to 83 inches a year.

Norway reaches well into the Arctic Circle and hence has very long days and nights. In Christiana the sun is above the horizon but six hours on the shortest day of the year. The longest winter is in the region of Finmarken (northern province) and consists of 243 days. The temperature is very low at times in the coldest sections. In the extreme northern part of Norway there is no darkness from the end of April to the middle of August.

In the valley depressions of the high plateau the climate is free from the cold of the peaks and grain and potatoes can be raised as far north as 70°. The wind blowing across the Gulf Stream moderates the climate on the west coast of the country and makes it warmer than the inland.

PASTURES—Cattle breeding is one of the principal occupations of the farmers. The mountain sides provide pastures and the foraging around the rough sections seems to give young cattle strength to withstand the cold. Most of the farmers hold summer upland pastures, together with their lowland farms, and in the open season they generally occupy themselves with dairying. The upland pastures are so distantly removed that it is necessary to make yearly summer pilgrimages to the mountain places



Mountain Summer Factory and Home (Sater).

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

(Sater). Some member of the family, usually women, are assigned to care for the flock, to milk the cows and goats and to make cheese and butter from the milk during the summer stay (Winkjer).

The grass that is not needed for pasture is mowed and stored for winter use. These conditions have made dairying the largest branch of the agricultural life.

CATTLE—Norway has four sources on which to depend for its milk supply: Cattle, sheep, goats, and reindeer. The number of cattle in 1923 was 1,131,000, of sheep there were 1,525,-

000 and of goats 242,000 head. The reindeer numbered nearly 150,000 in 1907 when last reported.

"From the ancient sages we learn that there were two breeds of cattle in Scandinavia. One was a small, white or white-spotted, hornless breed living among the mountains in north Sweden; the other was a large breed, black in color and similar to the cattle of Jutland. At the entrance of the Goths there was another highly prized, large-horned breed, either red or yellow in color, which appears to have been introduced by them. The Thelemarken breed of southern Norway is a direct descendant of *Bos Frontosus*." (Morse.)

The last-mentioned breed now gives an average of 6,000 to 9,000 pounds annually which tests 3.6 to 4 per cent fat.

The small breed of cattle were notably good milkers. Animals of the Thelemarken breed weigh only about 660 pounds each. The coast cattle are also small in size.

The native cattle have been crossed with Holland and English dairy breeds and while there was poor success for a while the breed thus developed is progressing rapidly. The Government has greatly improved the breeds by keeping well-bred bulls for service at a nominal fee.

Red poll cattle have been introduced but not yet developed.

The sheep of Norway are the result of numerous crosses of native sheep with foreign breeds.

The reindeer have been domesticated and is one of Norway's most useful animals. It produces meat and milk, and is also used to pull the sleds.

The yield of milk from all farms averaged as follows:

	Pounds per cow
1910	3,350
1915	3,366
1920	3,303

The milk yield of the best farms averaged much more per cow:

	Pounds
1910	4,402
1915	4,470
1920	4,449

The production of the cow-testing associations was even greater:

	Pounds
1913-14	4,833
1914-15	4,383
1915-16	4,389
1916-17	4,713
1917-18	3,785
1918-19	4,147
1919-20	4,581

DEVELOPMENT—Norway asserts that her butter and cheese were renowned long before many parts of the world were acquainted with these dairy products. Norway had an export trade in butter in the 13th century. For hundreds of years all the cheese was made by the farmers' wives. The principal type was called "Gammelost." Another kind was made from the milk or whey of goats and cow milk mixed and was called "gudbrandsdals mysost."

The making of cheese was gradually taken from the farm as cooperative factories were established for its manufacture. These factories were begun in 1855 and Norway, therefore, claims to be the pioneer in cheese-factory operation. In 1902 there were 650 cooperative societies in the country. The first factory cheese was that made by the women for centuries and the factories used the time-honored recipes. They were called gammelost, plutost (caraway cheese) and mysost. The latter is not really a cheese as it lacks caseinogen, but it contains the nutritious elements of milk, has a good flavor, and is easily digested.

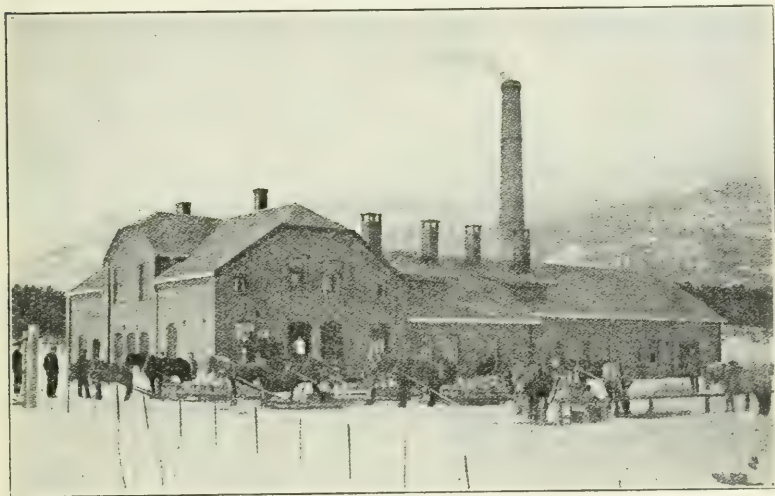
At present the following kinds of cheese are made:

- | | |
|---|---------------|
| 1. Swiss (Emmenthal). | 7. Gammelost. |
| 2. Gouda (fat or half-fat). | 8. Plutost. |
| 3. Nokkel ($\frac{1}{2}$, $\frac{1}{4}$, or skim). | 9. Primost. |
| 4. Gudbrandsdals mysost. | 10. Leyden. |
| 5. Hotengsost. | 11. Stolzen. |
| 6. Mysost (whey). | |

In order to protect the buyer, regulations were put into effect in 1922 making it obligatory for every cheese leaving the country to bear one of the following stamps:

"Full Fat Cheese K.45;" "Half Fat Cheese H.28;" "Quarter Fat Cheese H.18;" The Mysost must be stamped "Genuine goat cheese E. G.;" "Gudbrandsdals Mysost G.28;" "Cream Mysost F.28."

MILK.—The total production of milk in Norway according to the International Institute at Rome, Italy, was: 1907—2,470,000,000 pounds, 1915—2,470,000,000 pounds, and in 1920—2,420,000,000 pounds. Of this milk there was consumed as milk 55.5 per cent in 1920, and 24.1 per cent was made into



Winter Cheese Factory.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

butter, 12.1 per cent made into cheese, 3.8 per cent into condensed milk and 4.5 per cent of the milk was fed to livestock.

The factories are in central districts and operated by hydro-electric power. The consul of the United States reported that the growth of the chocolate, cheese and condensed-milk industries is causing dairying to assume ever-increasing proportions.

Prior to the World War Norway shipped large quantities of whole milk to England but England has succeeded in producing a supply of milk and with the aid of condensed milk has reduced imports of whole milk to almost a negligible quantity. This, however, gives Norway more milk to be used in making dairy products.

CONSUMPTION—The Norwegians and Swedes have about the same habits in relation to meals and eating, that is, the meals consist of breakfast, luncheon, dinner, luncheon, and supper dur-

ing the working seasons. The luncheons are nearly always composed of cheese, bread, and coffee. Cheese is not used in cooking in that country. The "old cheese" and the soft cheese, similar to cottage cheese, are consumed when quite ripe and, therefore, strong of odor. The people consume the full-milk cheese and part skimmed as well as the whey and primost cheese. All cheeses are consumed in practically the same way regardless of the flavor or texture.

COOPERATION—The first attempt at cooperation in the production and trade of milk products dates back 70 years (1855), but it was not until the last decades of the nineteenth century that the movement grew with marked rapidity. Prior to that time it was mostly theory and speculation.

In 1885 the first cooperative creamery was founded; since that time the increase has been pronounced as indicated by the following table:

Year	Factories	Year	Factories	Year	Factories
1855	1	1895	469	1919	419
1860	3	1900	734	1920	417
1865	7	1905	663	1921	430
1875	39	1910	618	1922	470
1885	188	1914	660		

In 1910, in addition to the 618 cooperative creameries and cheese factories, there were 120 private dairies and cheese factories, that is, in all, 738 factories. These plants handled more than 500,000,000 pounds of milk within the year.

In many parts of Norway it is difficult to get a sufficient quantity of milk to start a creamery or cheese factory. Under these circumstances unions have been formed for the sale of butter. On a given day of the week each member brings his butter to the society where it is again worked and reduced to a single mass of the same quality which, at least, has the advantage of being uniform and, therefore, sells at a higher price. The first society of this kind was formed in 1871. In 1912 there were 73 societies and in 1921 there were 43 societies. The business of each is not large, averaging only about 15,000 pounds.

The excellent results obtained by the cooperative selling associations of Denmark impelled Norway to organize similar societies. In 1915 there were six selling societies for the export of butter.

Each society is formed by the union of a number of factories, usually from 10 to 20, and the object is to get contracts more favorable to the members. Their chief effort is directed toward the enlarging of the trade with England. No member factory can conclude contracts without the consent of the society. Standards are established looking toward the improvement of butter for export. In the year 1903-4 these societies exported 3,220 112-pound barrels of butter and 5,207 barrels in 1911-12.

CITY MILK SUPPLY—Two cooperative city milk-supply societies were formed in 1913 to supply milk to Christiania and Bergen. Originally the dairies sold their milk direct to the retail dealers, but gradually the carriers began buying the milk and selling it to the dealers, until there were 45 wholesalers in Christiania. The number of dealers eventually naturally caused a high price for the milk. Direct sale of milk was then attempted, which resulted, finally, in the formation of the cooperative milk-supply society including 70 dairies in the city of Christiania in 1914. This society is well equipped and very modern in every respect.

In 1906 the union of agricultural cooperative societies of Norway was formed and now comprises 150 societies.

DAIRY SCHOOLS have been established throughout Norway at dairy centers and most of the schools are for women only. Of the 16 schools 11 are for women only.

IMPORTANT EVENTS

Date	Events
A. D. 874	
1200-1300	Norway had a trade in the export of butter.
1855	First cooperative cheese factory began operations.
1855	First cooperative fertilizer society organized.
1866	First consumers' society formed.
1869	First effort at cooperative seed-purchasing society.
1871	Cooperative butter-selling society formed (butter blending).
1885	First cooperative creamery founded.
1895	First cooperative export society founded.
1896	Cooperative societies federated at Christiania.
1898	First cow-testing association organized.
1906	Union of cooperative agricultural societies.
1910	Cooperative committee formed lecture and educational courses.
1912	There were 28 margarine factories—per capita consumption 23.7 pounds.
1913	First cooperative city milk-supply association formed.
1918	Rationing during World War, $\frac{1}{2}$ pint milk for adult, children 5 to 15—1 pint, under 5 years $1\frac{1}{2}$ pints.
1922	Export cheese required to bear print showing fat content and weight.

NUMBER OF COWS, TOTAL CATTLE AND REINDEER IN NORWAY

Year	Cows	Total Cattle	Reindeer
1845	.....	842,568	90,273
1855	.....	949,935	116,891
1865	.....	953,036	101,768
1875	741,598	1,016,617	96,567
1890	706,925	1,006,499	170,134
1900	689,563	950,201	109,000
1907	727,898	1,039,000	142,623
1910	755,483	1,134,613	.....
1914	.....	1,146,000	.....
1915	.....	1,121,000	.....
1916	782,000	1,126,000	.....
1918	.....	1,085,707	.....
1919	.....	1,053,743	.....
1920	705,688	1,095,000	.....
1923	.....	1,131,120	.....
1924	.....	1,114,433	.....
1925	.....	.....	.....

IMPORTS AND EXPORTS OF DAIRY PRODUCTS

Year	Butter		Cheese		Condensed Milk	
	Imports	Exports	Imports	Exports	Imports	Exports
	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds
1859	2,417	.....	709	.....	.....	.....
1860	3,346	.....	647	.....	.....	.....
1870	3,259	.....	468	.....	.....	.....
1880	7,427	3,677	529	.....	.....	862
1890	5,404	465	877	172	.....	5,911
1900	525	3,201	940	78	.....	14,611
1909	682	3,446	570	265	2	31,076
1910	789	2,736	622	455	1	31,521
1915	74	3,607	491	680	7	25,099
1918	2,499	0	223	0	16	0
1920	8,098	5	3,146	164	3,697	9,756
1921	7,560	29	1,157	256	1,211	6,555
1922	7,653	14	1,541	658	831	15,451
1923	5,825	26	1,962	422	985	16,070
1924	1,273	414	1,106	697	.....	.....
1925	.....	.....	.....	.....	.....	.....

FINLAND.

NATURAL CONDITIONS—Finland is situated in the northernmost part of Europe. Roughly speaking, it is between the 60° and 70° North latitudes. The surface of Finland measures 145,685 square miles, of which area 128,592 square miles (88 per cent) are land and 17,093 square miles (12 per cent) are covered with water.

There are no high mountains or extensive plains in Finland. The greater part of the country is low lying, although hilly. It is well watered and is often called "The land of a thousand lakes." Notwithstanding that Finland is so far north the climate is not so cold as that of other countries in the same latitude. This is chiefly due to the Gulf Stream and southwest winds. The mean temperature is about 5° C. (41° F.).

RAINFALL — The yearly rainfall over the whole country averages nearly 21 inches, a considerable portion of which is in the form of snow. Snow falls first in November and reaches its greatest depth in March. The snow varies in depth from 8 inches to 24 inches from South to North.

GRASSLANDS — In 1910 there were 4,639,240 acres of arable land and 2,369,735 acres of pasture. During the centuries of toil the Finnish people have won this land from a wilderness of forests, hills, ridges, lakes, and swamps. About 60 per cent of the land of the country is still covered with forests, and about 30 per cent with swamps, while only about 9 per cent is under cultivation. The soil is peculiar, as there are absolutely no vegetable molds to be found in the country. Three grasses predominate, namely timothy, red clover, and Swedish alsike.

PEOPLE—Practically all the people are Finns and Swedes—Finns 88 per cent and Swedes about 11 per cent—while in the northern part of the country there are about 1,600 Lapps. The remainder are mixed. About 15 per cent of the people live in towns and cities, the remainder living on their lands.

ANCIENT AND MEDIEVAL HISTORY—In the first centuries there apparently lived on the western coast of Finland a people of

the same race as the Swedes. It is thought that between the years 400-700 A. D., the western Finnish race on the eastern coast of the Baltic settled in its present home. The inhabitants of Finland proper and Tavastland came to Finland across the sea from Esthonia and spread north to the White Sea.

When the Finns arrived in the Finnish peninsula they were not in a stage of complete barbarism. In their previous home, in the neighborhood of the Duna River, the Baltic Finns came in contact first with the Lithuanians and then with the Goths, from whom they received important influences, as is shown by the language, in regard to cattle breeding and agriculture, dwellings, dress, tools, weapons, and navigation, and in social and religious customs.

The Swedish population now living on the southern and western coasts settled there during the ages of the vikings and the Swedish crusades. The Swedes, who were troubled by viking expeditions undertaken by the Finns, made themselves masters of Finland in three crusades. The Finns gradually assimilated the system of government, customs, etc., of the Swedes. Hence, Finland is peopled from the neighboring countries and is a resultant of the combined influences of all of them.

From the time of the crusades of the Swedes down even to the World War, Finland had to contend against Swedes on one side and the Russians on the other, and ever and anon Finland was the fighting ground for Sweden and Russia.

At the end of the Thirty Year War in Europe large baronies were distributed to victorious generals and other nobles, mostly Swedish, and thereby feudalism increased rapidly. The position of the peasants became more and more intolerable and by the end of the reign of Queen Christina two-thirds of the land and half of the ordinary revenue had been alienated from the state as gifts.

Great famines existed in 1695-97 and were called the "Great Death."

In 1809 Sweden was compelled to cede the country to Russia. It remained under the domination of Russia until the World War, when, in March, 1917, its freedom was declared, and aside from civil strife the country has had about the only period when prosperity and development were possible in its history.

DEVELOPMENT—The development of the country was retarded throughout all these centuries by oppression and the people,

while largely agricultural, had neither chance nor hope for constructive progress in agriculture and stock raising; however, in the last decade, 1910 to 1920, the progress was rapid. Butter from Finnish dairies has won recognition in foreign markets and during the year before the war the exports of butter amounted to 27,867,000 pounds. Even with the handicap of an unstable government, considerable improvement in agriculture, scientific farming,



The Cooperative Dairy at Huittinen, One of the Greatest in Finland.

the use of fertilizer, and modern methods of bog cultivation have gained ground. This progress has been furthered by the formation of joint-stock, or cooperative, companies. Progress has also been much impeded by the lack of capital.

COOPERATION—Most of the dairies of Finland are operated cooperatively. The chief products are butter and Gruyere cheese. At one time even the cooperatives sold their produce through the wholesale dealers, but not being satisfied with that plan 17 of the largest cooperatives in 1905 formed an export society known as "VALIO." The society has developed to such extent that 80 per cent of the butter went through it in 1924. Its original purpose was to export butter but since that purpose was accomplished successfully other products have also been sold by the

society. Cheese has not been made on a large scale but the Valio society helped develop that industry and in 1920 it sold 1,812,000 pounds and by 1924 the sales amounted to 4,189,000 pounds, of

Finnish Tarkast brands.



Quality Mark of Finnish Cheese.



a.



b.



c.

FIG. 4.—Finnish Tarkast brands.—
(a) For export butter under Government control. (b) Additional mark for butter of first quality (c) For export butter not under Government control.

which 2,656,000 pounds were exported. The 20 years' business of the Valio has been very encouraging to the cooperative organizations of Finland.

FACTORIES—About a century ago cheesemakers from Switzerland came to Finland and began to manufacture Swiss cheese. This industry remained in the hands of private owners, Swiss and Danes. The cheese was sold partly in Finland and partly in Russia. In 1921 there were 297 creameries affiliated with the Valio exporting association and three-fourths of them were co-operative. The butter exported the same year amounted to 10,976,000 pounds. The state aided and directed the cooperative societies from the beginning.

Just prior to the World War a law was passed which prohibited margarine imports, as Finnish butter had been said to con-

tain that substance. In the year 1919 there were 426 cooperative dairies, cheese factories, and creameries, to which 41,500 farmers delivered more than 32 million gallons of milk. Nearly $13\frac{1}{2}$ million pounds of butter were made in these cooperative factories, together with a small quantity of cheese. However, much cheese was made on the large estates and there is also a large quantity of butter made on farms in Finland. This farm butter is partly consumed on the farm and partly sold as farm butter.

During the World War the lack of imported feeds for cattle caused a decrease in the milk supply but that has again resumed normal flow and in the last few years has greatly increased. The position of the farmers and laboring class has been improved and in turn they have consumed much more butter than in former times.

Besides the native type of cheese the Finnish cheesemakers manufacture imitation Cheddar, Dutch, and Gruyere, which are largely consumed locally.

COW-TESTING ASSOCIATIONS—The first cow-testing society was formed in 1898, and in 1913 there were 132 associations with 42,392 cows under test. In 1922 the popularity of the association work was shown in the increase—267 associations and 82,166 cows under test.

CATTLE — White cattle are native to the country while reindeer were imported, and horned cattle came from Russia, Sweden, Denmark, Holland, and England. Three breeds are especially noted in the country:

1. The Montagnard breed in the North, ($64-66^{\circ}$ North latitude) are without horns and are somewhat like the Swedish and Russian breeds. They are not heavy milkers but give about 550 gallons a year. The milk is said to be very rich.

In addition to the white, hornless cattle there is also a spotted, hornless breed, related to the former.

2. Kiuruvesi, in northeastern Finland, is a dun-colored breed with a white stripe along the back. The milk yield is about 440 gallons a year.

3. Savastren, in South Finland, is reddish colored, and yields an average of 580 gallons of milk.

These three breeds of cattle are perceptibly affected by the climate and the quantity and kinds of feed available. They are

small and ungainly but hardy and economical and very susceptible to improvement. The Finnish cattle are already crossed, especially in the South, with Friesian and Ayrshire cattle. The government is now trying to improve the cattle by selecting among the native breeds and crossing with the Ayrshire. Liberal government



The Cooperative Dairy of Ylistaro for Manufacturing of Butter and Cheese.

bounties have been distributed for this purpose. In 1922 the number of Ayrshire cows, including grades, was about 4 per cent of the total cattle.

In 1887 United States consular reports indicated that the Ayrshire breeding stock was imported into Finland as early as 1854 and that crossing at that time had become extensive. There was also reported the use of Flemish cattle, red and white, in crossing with the native breeds.

The housing of cattle is necessary for 9 months of the year and they are allowed on pasture but 3 months. During the winter the cattle are fed hay, oats (crushed), linseed cakes, wheat bran, oats, acorns, and straw.

SCHOOLS — There are two dairy schools, one experiment station, 22 middle schools, 48 lower schools on agriculture, and an agricultural society in each province.

CHRONOLOGICAL EVENTS

YEAR

- 400-700 A. D. Settled by Finns from Esthonia.
 1695-7 Great famines, "Great Death."
 1797 Finland domestic economy society established.
 1809 Finland ceded by Sweden to Russia.
 1823 Swiss cheesemakers came to Finland to make cheese.
 1854 Ayrshire breeding cattle imported.
 1855 Sippola cheese first made.
 1885 First cooperative creamery established.
 1898 First cow-testing association formed.
 1905 Butter-export society formed by co-operative creameries, Valio.
 1914 World War.
 1917 Finland declared independence from Russia.

NUMBER OF COWS, TOTAL CATTLE, REINDEER, AND GOATS
 (Statistisk Årsbok)

Year	Cows	Total Cattle	Reindeer	Goats
1865	670,897	954,321	.....	.....
1870	687,960	997,960	.....	.....
1880	795,575	1,132,002	.....	.....
1890	928,276	1,305,187	.....	.....
1900	1,072,002	1,427,560	.....	.....
1910	1,142,908	1,573,163	.....	.....
1911	1,150,500	.....	.....	.....
1912	1,151,659	.....	.....	.....
1913	1,141,757	.....	.....	.....
1914	1,164,229	1,603,720	.....	.....
1915	1,114,447	1,537,936	.....	.....
1916	1,080,558	1,501,975	.....	.....
1917	1,075,749	1,500,670	.....	.....
1918	1,046,935	1,438,573	.....	.....
1919	1,071,162	.....	.....	.....
1920	1,179,989	1,824,174	.....	.....
1921	1,218,622	.....	.....	.....
1922	1,259,608	1,843,523	.....	.....
1923	1,277,664	1,864,645	61,027	11,577
1924	1,288,735	1,864,469	61,009	11,709
1925	.....	.....	.....	.....

TOTAL MILK PRODUCTION
 (Milk and Its Products, Rome)

Year	Production	Year	Production
	1,000 Pounds		1,000 Pounds
1917	3,235,907	1920	3,467,967
1918	2,602,577	1921	3,796,247
1919	2,761,509	.....	.....

PRODUCTION OF BUTTER AND CHEESE IN FACTORIES
(Milk and Its Products, Rome)

Year	Factories			Butter Made	Cheese Made
	Butter	Butter & Cheese	Cheese		
				1,000 Pounds	1,000 Pounds
1909	671	70	10	26,586	3,397
1910	614	78	5	26,281	3,428
1911	570	82	6	28,151	3,845
1912	553	93	6	28,124	3,997
1913	554	93	7	30,618	4,623
1914	541	106	3	29,802	5,428
1915	472	91	3	26,747	4,092
1916	420	89	4	27,785	3,940
1917	387	95	3	22,761	4,599
1918	356	63	4	13,457	1,925
1919	350	70	10	15,258	2,250
1920	360	66	26	17,776	4,590
1921	362	76	23	20,832	7,258
1922					

IMPORTS AND EXPORTS OF DAIRY PRODUCTS
(Milk and Its Products, Rome)

Year	Milk and Cream		Butter		Cheese	
	Imports	Exports	Imports	Exports	Imports	Exports
	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds
1909	225	16,777	2,401	25,645	426	1,692
1910	210	21,799	1,416	24,472	351	1,827
1911	363	24,394	1,316	27,230	556	2,189
1912	895	26,663	3,388	26,474	538	2,023
1913	1,083	37,626	3,333	27,867	520	2,699
1914	1,082	49,074	2,959	24,567	494	2,984
1915	852	73,563	4,916	20,016	198	3,834
1916	718	103,607	3	8,960	49	4,126
1917	389	51,966	24	4,127	1	657
1918	1	388	230	1,048	231	5
1919	0	0	11	879	18	39
1920	0	208	5	2,508	2	2,106
1921	0	1,039	14	14,253	3	4,686
1922	0	1,540	29	18,374	8	5,989
1923	10	993	103	14,476	23	2,944
1924	.....	.....	.....	17,820	.....	.....
1925	.....	.....	.....	.....	.....	.....

BALTIC COUNTRIES AND POLAND

LATVIA—Latvia became independent in 1919 thereby freeing itself from centuries of domination and much oppression. It is one of the small countries of the world, having an area of 24,440 square miles, (15,641,600 acres). The land is generally low and the climate is moist, there being an abundant rainfall.

CATTLE — The cattle of Latvia are similar to those of Esthonia and Lithuania. In 1923 there were 580,000 dairy cows



Latvian Cow, Red and Spotted.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

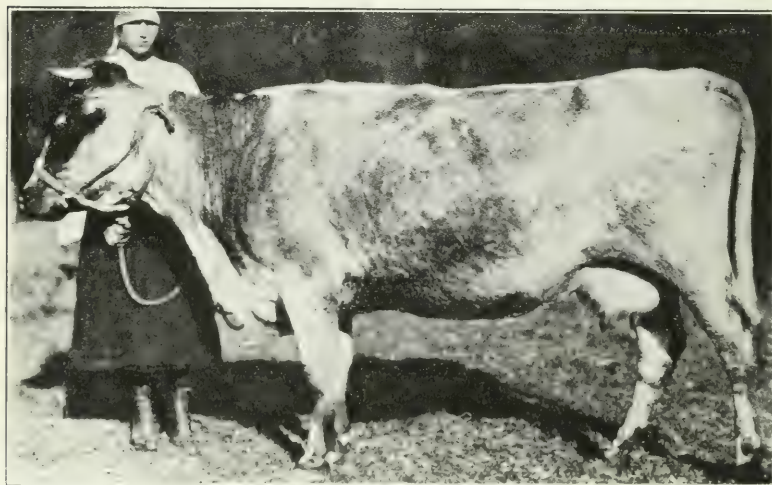
and 910,931 total cattle in the country. Large quantities of feed such as bran, oil cake, and fodder are imported. The total number of cattle in 1925 was 906,651. The average yield of milk in 1913 was 4,518 pounds. The consumption of milk was estimated, for the same year, at 25.6 gallons per person.

DEVELOPMENT—The dairy industry is closely allied with the cooperative movement which has but recently been introduced.

The first cooperative dairy was established in 1909 and the first union of cooperatives was in 1912. There were 88 cooperative and 100 private dairies in 1914, just getting started when the World War broke out and practically destroyed the industry. Their recovery, however, has been rapid. The following table indicates the growth of dairy organizations:

Year	Cooperative dairies	Private dairies	Total
1914	88	100	188
1919	15	3	18
1920	16	5	21
1921	18	12	30
1922	85	43	128
1923			322
1924	322	126	448
1925	460	154	614

BUTTER — All butter for export is inspected by governmental officials and scored 1st, 2nd, or 3rd class. Fully 75 per



Latvian Cow, Bluish Gray.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

cent is claimed to be first class. A label is pasted on each keg to show the class. Large export firms and cooperatives handle the trade. The following are the principal exporters:

The Economic Union of Latvian Agriculturists, exporting 9 per cent.

Latvian Central Dairy Union, exporting 60 per cent.

Pollock & Co., (Danish), exporting 20 per cent.

Central Union, "Konzume," exporting 8 per cent.

The exports have increased recently: In 1921 there were only 33,000 pounds exported, in 1922 there were 2,090,000 pounds, and in 1923, 6,377,000 pounds.

In 1924 there were 347 central creameries in Latvia, that is 70 per cent of all creameries belonged to this class.

There are three ports of export, namely Riga, Libau, and Finau. Butter can be exported in lots of 2,204.6 pounds but not in smaller amounts. The first and second-class butters may be exported but the third-class can not be exported.

Butter production for the year 1923 was estimated at 57,980,000 pounds.

The first cow-testing association was organized in 1904; in 1914 there were 344 associations, and in 1922 there were 140 associations with 20,535 cows under test.

ESTHONIA—The area of Esthonia in 1920 was given as 16,955 square miles, (10,851,200 acres). The surface is generally flat and is extensively covered with pine forests; the soil is sandy and in some places marshy.

The principal occupation is agriculture. The meadows in 1922 covered more than 2,600,000 acres and there were also 1,800,000 acres of pasture lands. The large estates have been parceled out to the peasants in accordance with the recent agrarian law.

The population of the towns and villages is mostly German while the people of the rural districts are mostly Esthonians who belong to the Finnish race. The population in 1922 was 1,110,538. Esthonia was taken from the Swedes by Peter the Great, of Russia, in 1710, and has remained under the domination of Russia most of the time since. The conditions of dairying described for Russia up to February, 1918, when Esthonia declared her independence, applies in part to Esthonia.

EARLY HISTORY—The Esthonian people have lived in their present country since the earliest records. King Alfred stated

that in the 8th century the Esthonians could produce cold artificially which cold was used for the purpose of cooling ale, water, or for the keeping of dead bodies. In the 13th century the Knights of the Teutonic Order entered the territory and taught the people better farming. After the country had become subject to Sweden the land was given out to feudal lords and the village peasants became serfs and a fixed condition of servitude was established toward the end of the 15th century. The period of Swedish domination led to an improvement in the condition of the peasants and servitude was abolished in 1816. In 1840 the Esthonian Diet decided to detach a part of the land from the lords and to assure the peasants an irrevocable right to use it, and methods were made whereby the peasants could obtain the remainder of the land.

While the country was under the domination of Russia progress was in all lines and the dairy industry remained undeveloped. When the country became independent there were 442,669 head of cattle within its borders, but in 1923 the number had increased to 512,533, of which 316,405 were cows.

The increased activity in dairying is shown by the quantities of butter exported, according to the Smor Tidende dated February 1, 1924. In the year 1921 the exports were 110,000 pounds, in 1922—1,035,000 pounds, in 1923, 2,335,000 pounds, and in 1924 they were 7,025,000 pounds.

The Esthonian government has rigid control regulations and permits the export of only first-class butter and other dairy products.

CATTLE—The cattle of Esthonia are similar to those of Finland and Russia with some herds of dairy breeds from western Europe.

Esthonia has some very modern creameries, 75 per cent of which are operated by steam.

LITHUANIA—Lithuania is one of the oldest of the Baltic States in point of occupation of the people. From this people the Finns received most of their types of cattle and much of their foundation of modes of living. These people have been agriculturists for centuries. While under the dominion of other countries the development was slow but appears to have been well grounded, as indicated by developments since their independence, in 1919.

The number of cattle in Lithuania in 1923 was 1,285,000, and in 1924 it was 1,252,000.

Dairying is more backward in this country than in the other Baltic States. The development of cooperative organizations has just begun and some very successful societies have been founded.



"Sultans" Lithuanian Bull.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

There is one "Union of Agricultural Cooperative Societies," containing 42 breeding stations which were established by two large cooperative societies, for the improvement of dairy cattle.

In 1923 the exports of butter amounted to 293,212 pounds, and the cheese exports were 903,886 pounds.

COW-TESTING ASSOCIATIONS—It is stated in a U. S. consular report of August, 1925, that there were in the country 50 herds of milk cows which are registered with the "General Union of the Control of Milk Cows." The quality of these must be very good, for the report further states "Some of the cows give an average of 8,800 pounds while others give 6,600 pounds per year."

POLAND—Poland was an independent state until the end of the 18th century. The people are Poles and Slavs with some German intermixed. The country was divided between Prussia, Austria, and Russia. One partition was made in 1772, a further

partition was made in 1793, and in 1795 the last and final one was made, taking the last of the country. Poland remained under the dominion of these countries until the year 1918, when its independence was proclaimed. During all the period up to 1918, the dairy industry was woven into the other countries of which it was a part, and, therefore, partook of the cattle, methods, and development similar to the country of which it was a part.

The area of Poland in 1921 was 149,359 square miles and the population was 27,192,674, or 182 persons per square mile. Poland is essentially an agricultural country, as the large estates, of which it has many, have held dairying back. It was not, however, until 1920 that a law was passed limiting, under certain conditions, the size of estates.

There were 7,894,585 head of cattle in the country in October, 1921.

The principal hope for dairying is in the cooperative movement which has become quite popular in that country. The leader of the cooperative movement, Stanislaw Wojciechowski, was afterwards selected president of the republic.

BALTIC COUNTRIES AND POLAND CHRONOLOGICAL EVENTS

Date

7th century	Esthonia had a form of artificial refrigeration.
1400-1500	Esthonian peasants became serfs under Sweden.
1710	Esthonia taken by Peter the Great.
1795	Poland partition completed.
1816	Esthonian serfs freed.
1840	Esthonian serfs given rights to part of land.
1904	First cow-testing association in Latvia.
1909	First cooperative dairy founded in Latvia.
1912	First union of cooperatives in Latvia.
1914-18	World War and revolutions. Dairying practically destroyed. States become independent.
1922	Baltic States established control regulations on exports of dairy products.

RUSSIA

(Union of Socialist Soviet Republics)

Land, Grass, Grain, Cattle, Dairying

NATURAL CONDITIONS—"It is difficult to realize the vastness of territory and immense resources of Russia. Comprising a sixth of the whole land surface of the earth, it represents the greatest single country in the world, and holds the largest white population. It extends from regions of perpetual ice to torrid lands, covering within its bounds every kind of climate and every kind of soil, while fifty races speak their several tongues and follow their customs; but generally with one mind, enveloped in what is recognized throughout these vast areas as the Soul of Russia." (Russia, Vol. III, Nos. 10-11, 1918.)

European Russia forms an extensive plain, which at no point from the Black Sea to the White Sea, or from the Carpathians to the Urals, attains an elevation of 1,000 feet above sea level. Its climate is markedly continental and is characterized by great differences of temperature in winter and summer, a rapid transition from hot to the cold season and vice versa.

The very size of Russia has interfered with its development. Only about 15 per cent of the people live in the towns and cities while the remainder of this vast population of 120 millions are scattered over the entire domain and are entirely engaged in agriculture and stock raising. They live in little settlements and it would require a gigantic railroad system to connect them with the outside world, but meanwhile the growth of population has gone forward in numbers.

The peasants of Russia, representing 85 per cent of the population, were released from serfdom in 1861 and given land upon which to provide for an existence. Before the World War the ownership of land in European Russia was divided as follows: The Crown and the State, 35 per cent; the peasants 35 per cent; private holders (chiefly nobility) 14 per cent; all other private land holders, 12 per cent; and the church and its institutions, 4 per cent.

Until the war the peasants' lands were held under two different systems—communal and individual holdings. The communal

system provided a given area of land, to be divided among the peasants (hearths) for cultivation, the number of male workers in each family being considered in the division. This land was so held and worked for a period of about 20 to 25 years, when a redistribution took place to meet the increase or change of population. In addition each family had a small piece of land in the village for a permanent residence. The system of individual holdings gave the peasants a perpetual tenure for residence and also a fixed use of the communal lands. A peasant's family in this class could rent or sell his allotment. The peasants had to pay for the land under either system.

Since the Soviet regime began the land has been worked in much the same way as before, although the government claims ownership of all land.

EARLY CONDITIONS—At the end of the reign of the Huns and Scythians Russia and Siberia were left an unorganized territory saturated with slavery and serfdom which required centuries to cure. These people had always been rather nomadic and lived much on income from their cattle. The eastern customs predominated over the western customs and with the utter lack of transportation facilities agriculture could not expect much encouragement except on the borders, where exports were possible. The production of grain enough for consumption on the farms required little effort and could be accomplished without the aid of modern implements or science, but when grain was produced for export in competition with other countries it became necessary to adopt later and better methods of farming. Until 25 years ago practically the sole object of stock farming in Siberia was to procure a quantity of butchers' beef for local needs. It was much the same in European Russia.

The peasant farmers were established in villages, or communes, and each house had its pens and stables at the back of it, and over these buildings the hay was stored. Each farmer kept from 3 to 5 cows, and a horse or two; occasionally a farmer had 20 to 25 cows. On one side of the village was a common pasture for all the cattle of the commune, the owners paying into the town treasury a tax for each animal pastured. The land to the other side of the village was measured out to the various households and used for cultivation of all crops. The farming was originally very primitive.

The group workers, or "artels," as they were called, had existed in the country for many years. These groups consisted of about a dozen men who would agree to pool their labor for a certain piece of work and when the work was completed the group agreement was discontinued. From the artels it was but a small step to the co-operative system of operation of factories and stores. Conditions were not suited to co-operation prior to 1900.

In 1872 the merchant could no longer buy his serfs and therefore free labor began to work in factories, making better products than the serfs had done. However, 79 per cent of the people were illiterate.

CATTLE—It is possible to give but a general statement of the early origin of breeds of cattle in Russia. It appears clear that the Scythians furnished the base for all the present breeds of cattle in both European Russia and in Siberia. According to Morse the record shows as follows:

"Herodotus writes of the polled cattle of the Scythians, in what is now southern Russia, about 500 B. C. Werner says that these Scythians had a breed of brown cattle with long horns, and hornless zebus, as well as crosses between the two. Middendorf finds small hornless breeds in the woods of southern Russia which correspond to the Scythian cattle of Herodotus, and also says that the polled primigenius breeds of northern Russia came from this Scythian stock. In Finland and northern Russia the cattle are small but of primigenius type. The Cholmogory (Kolmogory) breed of northern Russia was the result of a cross of the native cattle with improved breeds from Holland." (Black-and-White.)

Cholmogory breed—(Kolmogory) also Great Russian. The Cholmogory, or Great Russian breed is a product of crossing the Archangel breed with Friesian cattle. The first crossings of this breed were at the time of Peter the Great, about 1700, and the breed has been kept up by the importation of Dutch bulls. This breed is found in the neighborhood of St. Petersburg (Leningrad). It is remarkable for its large yield of milk, some of the cows giving five times their own weight in milk in one year. The average yield of milk is from 4,200 to 5,600 pounds while the maximum is as high as 8,500 pounds.

In form these cattle have elongated bodies, concave backs, and sloping hind quarters. There are a variety of colors. In some dis-

tricts black and white prevail and in others the cattle are red and white. The Russian cattle are grazed in summer and fed hay and grain in winter.

Other Breeds—The cattle raised in Russia are generally local breeds and are seldom crossed with foreign cattle. They are usually small, being from 3 to 4 feet in height. There are a number of these local breeds whose names generally indicate only the locality in which they are found. 1, Gray Tcherkasky; 2, Black Sea; 3, Don; 4, Orenburg; 5, Simbrish; 6, Samara.

In the north of Russia the cattle are kept chiefly for dairying and manure. The breeds are small and not good milkers. They develop slowly and the meat is coarse. In the southern part of Russia the cattle are kept as beasts of burden and for meat. In southeastern Russia the cattle are kept principally for meat and tallow, and are poor milkers. The Baltic Provinces have the Angel, Oldenburg, and Cholmogory breeds, all of which are good milkers and average more than 4,500 pounds a year.

A great many foreign breeds, Jersey, Guernsey, Friesian, and Shorthorn, have been imported for the private estates and many have been taken as far as Siberia. They seem to thrive very well in all parts of this great country.

DEVELOPMENT PERIOD—With the beginning of the factory system of dairying (1860-1870) and the improved transportation facilities brought about by the railroad and steamboats, Russia also began to see the light and slowly planned for improving her agriculture and dairying.

The first cheese factory was established by Prince Metchersky in 1795, manufacturing Emmenthal cheese. In 1852 the Russian cheese was common but was not made in sufficient quantities for any material export.

The "artels" were developed from 1865 to 1900 and were largely used throughout the country.

The first cooperative creamery was established at Otrakowitchi, by M. Werestchaguine, in the province of Twer, in 1866. In 1871 M. Werestchaguine founded a school for teaching dairying. The cream separator was introduced in 1880, while cooperative stores and cooperative consumers' organizations were established about 1860.

The new period in Russian agriculture was from 1890 to 1905 and marked the beginning of the introduction of modern agricultural implements, legume crops, especially clover, and agricultural education. More intensive agriculture was developed and the great harvests of 1908-10, and 1913, with good international markets, and reforms in land tenures caused a great stimulus in agriculture. The importation of farm implements in 1906 amounted to only 40 million rubles, while in 1913 they amounted to 130 million rubles. Agricultural societies in 1895 numbered only 175 and in 1914 there were 4,685; the number of cooperatives, chiefly dairying, grew from 17 in 1898 to 1,254 in 1914. Loans and savings increased and the total of all peasants' cooperatives was estimated at 22,000 societies in 1912. Agricultural colleges increased in number from 82 in 1895 to 360 in 1913 and the students from 4,000 to 18,000. There were only 27 experiment stations in 1895 but in 1914 there were 240.

During this time the Siberian conditions changed also. A number of foreigners had formed a company in 1893 to sell cattle and implements to peasants, and in 1894 the Trans-Siberian railroad was completed and the first creamery built at Kurgan. In 1896 Mr. Palison, a Danish dealer, formed a company to export Siberian butter.

The first cooperative creameries, during the period from 1897 to 1902, were fought vigorously by the owners of private factories. All the usual efforts were used to prevent these cooperatives from becoming successful, even to buying cream at a price higher than it would bring when made into butter. The cooperatives succeeded in spite of the opposition and increased rapidly in numbers.

In 1901 there was organized at Kurgan a butter-export association and the same year the first dairy was organized on the Danish plan in Siberia. The next year Alex. N. Balakschin presented a memorandum to the minister of agriculture setting out in detail the importance of the buttermaking industry in Siberia and the necessity of organizing it on a cooperative basis. The government adopted the plan, formed a society to carry out the purposes, and appointed M. Balakschin in charge of it. In 5 years he helped organize 271 creameries in the face of very great opposition of

private capitalists and manufacturers. He worked for a union of the artels, which was achieved in 1907.

In the years 1904 and 1905 the Russo-Japanese war interrupted the progress which was being made prior to that time.

The first cow-testing association was formed in Latvia in 1904, and in 1906 the agrarian reform began and much land was sold to the peasants.

From that time to the beginning of the World War the organization and federation of cooperatives was the order of the day and especially was this true in Siberia. The constant purpose was to improve the trade in the production and export of the two greatest products of that region, butter and grain, with some products of the cheese industry. In connection with this cooperative producing associations, societies for the consumers, buying societies, and credit organization sprang up, covering many agricultural and dairy lines of activity. In 1910 3,000 factories were making butter. Russia (European) had one cow for each four persons while Siberia had one cow to each two.

During the years 1912 and 1913 there was a great immigration to Siberia, amounting to 323,000 in the latter year.

WAR PERIOD (1914-1917)—The outbreak of the war placed the Siberian buttermaking industry in a difficult position. The usual purchasers of butter refused to buy even at a low price. The unions advised its members not to sell and asked the government for an advance on the butter which was granted.

Later the government needed butter for the soldiers and bought it at a good price. While the war lasted the creameries and their unions did not suffer. The union of Siberian creameries numbered 804 in 1914 and 922 in 1916, in 1917, 1,410, and 2,047 in 1918.

When the Bolsheviki came into power they began to limit the independence of the cooperatives throughout the country. In 1919 a law was passed decreeing that a certain part of the produce could be used and the remainder was to be turned over to the government. In fact the creameries were only agents to collect and deliver to the government. The government then nationalized the cooperatives and made them a part of the government but this took away their initiative and left them dead, as it were.

In 1921 the "New Economic Policy" restored to the cooperatives the right to sell, buy, and hire help, and they could organize on a simple declaration. However, their revival took place very slowly principally due to lack of credit and machinery for their factories. The lack of transportation has been a serious defect in the comeback of the cooperatives, as the railroads have also been neglected for years and their rolling stock and roadbeds are in very bad condition.

In 1923 there were 2,500 butter and cheese factories in Russia and Siberia.

In 1925, United States consular reports indicate, there were some signs of life in the dairy districts of Siberia. The "Maslo-centr" association includes 5,820 dairies and 680 cheese factories, which is about 80 per cent of the pre-war number, but this estimate is perhaps high. Ten large dairy associations have been organized in Siberia and similar ones are in course of construction in Ural districts and European Russia.

TRADE—The production of butter and cheese has been very large for many years; in fact, the earliest reliable figure indicate an export averaging nearly 7 million pounds a year from 1860 to 1870, and from 1885 to 1888 this was increased to over 11 million pounds; by 1900 it had reached about 43 million pounds and from the year 1910 it was over 100 million pounds with the highest point in 1913 when it was 172,000,000 pounds. During the World War the butter exports had decreased rapidly and practically ceased from 1918 to 1922 inclusive. The comeback of exports in 1923 was only to the amount of 10,978,000 pounds.

The cheese exports have not attracted much international concern but have exceeded a million pounds a year since 1876, the peak being for the year 1913 when 3,500,000 pounds were exported. The exports of cheese have not come back since the war sufficiently to make any show of exports.

The trade in exports of condensed milk has been rather large for a new industry. In 1914, 274,000 pounds were exported, and in 1915, 115,000 pounds.

IMPORTS—The imports of butter and cheese were from 2 to 4 million each just before the war.

CHRONOLOGICAL EVENTS

YEAR

- 1700 Cholmogory breed originated as a cross between Friesian cattle and the Archangel breed in the reign of Peter the Great.
- 1795 First cheese factory established by Prince Metchersky (Emmenthal).
- 1832-4 Cholera plague and war with Poland.
- 1852 Russian cheese common article of merchandise.
- 1854-6 Crimean War—serfs freed to pacify the country.
- 1861 Emancipation of serfs—land allotment.
- 1864 Zenstzos, founded to help cooperatives and establish export firms.
- 1865-1900 Origin and development of artels—group workers.
- 1866 First cooperative creamery established at Otrakowitchi, Twer.
- 1871 M. Werestchaguine founded a school to teach dairying.
- 1880 Cream separator introduced.
- 1890-1905 Modern agricultural implements and clover introduced.
- 1891 Famine.
- 1893 Financial crisis.
- 1893 A company of foreigners began selling cattle and implements to peasants in western Siberia, causing rapid development in dairying.
- 1894 Trans-Siberian railroad completed.
- 1894 First creamery built, near Kurgan.
- 1896 Mr. Palison, Danish dealer, formed a firm to export Siberian butter.
- 1897-1902 First cooperative creameries fighting for a start.
- 1898 M. A. Radzig estimated the number of dairy cows as 9,516,000.
- 1898 First Siberian butter pool.
- 1901 Society for the exportation of butter formed at Kurgan.
- 1901 First dairy society on Danish plan founded in western Siberia.
- 1902 Alex. N. Balakschin began the great cooperative movement.
- 1904-5 Russo-Japanese War.
- 1904 First cow-testing association founded in Latvia.
- 1906 Agrarian reform began. Land sold to peasants.
- 1906 Union of Siberian dairy societies founded.
- 1908 First all-Russian cooperative congress at Moscow.
- 1908 Law to encourage small cooperatives.
- 1908 Organization of cooperative creameries in Tomsk and Tobolsk.
- 1909 Altai union of creameries accomplished.
- 1910 3,000 factories were engaged in buttermaking.
- 1911 Federation of dairy artels of the Ural region.
- 1912 London company; the union of Siberian cooperative associations started.
- 1913 Great immigration to Siberia.
- 1914 Russia had 240 experiment stations.
- 1914-18 World War. Decrease in cattle estimated at 20 million.
- 1915 Trade of butter monopolized and placed in the hands of the cooperatives.

YEAR

1915	Shaniavsky University endowed by cooperatives (first in world):
1917	Revolution—Karensky government.
1917	Third all-Russia cooperative congress.
1918	Counter revolution by Bolsheviks.
1918	Centro-Soyus organized to cover all cooperatives.
1918	Decree in November abolishing rights to private property.
1918	Cooperative universities established: Moscow, Kiev, Leningrad, Omsk, and Tiflis.
1921	"New economy" policy reestablished rights to cooperatives to buy, sell, and hire help.

NUMBER OF COWS AND TOTAL CATTLE IN RUSSIA AS AT PRESENT CONSTITUTED
(International Institute of Agriculture, Rome)

Year	Cows	Total Cattle	Cows Compared with Total Cattle
			Per Cent
1860	.....	21,408,800	.....
1877	.....	27,322,219	.....
1881	.....	27,177,000	.....
1890	.....	28,541,400	.....
1900	.....	34,483,900	.....
1910	.....	36,301,602	.....
1916	22,234,100	50,081,800	44.4
1917	21,911,000	48,681,000	45.0
1920	21,952,100	39,058,900	56.2
1921	20,083,500	36,196,400	55.5
1922	18,194,200	32,976,600	55.2
1923	20,129,000	38,619,300	52.1

EXPORTS OF BUTTER AND CHEESE

(Russian Commerce Reports)
(Thousand Pounds—000 Omitted)

Year	Butter Export	Cheese Export	Year	Butter Export	Cheese Export
1860-70 ¹	6,842	216	.....	.....	.....
1871-75	5,876	36	.....	.....	.....
1876-80	6,695	1,089	.....	.....	.....
1885-88	11,651	1,861	1923	10,978	.....
1894-98	14,897	1,410	1924	73,488	.....
1900	42,923	1,490	1925	.....	.....
1913	172,003	3,506	.....	.....	.....

¹ 1860 to 1898 are yearly averages.

AUSTRIA-HUNGARY AND THE BALKANS

(Austria, Hungary, Czechoslovakia, Yugoslavia, Serbia, Albania, Greece, Rumania, Bulgaria)

AUSTRIA-HUNGARY

NATURAL CONDITIONS — In view of the many changes through which the countries of central and eastern Europe have gone in recent years, it appears best to discuss dairying for that section with some disregard to political boundaries, especially as dairying does not conform closely to boundaries.

The climate and physical conditions of Austria-Hungary (old boundaries) are very favorable to cattle raising and dairying. The pastures are extensive and very good. Cattle have been a source of food and profit for many years and the history of dairying reaches far into antiquity.

A United States consular report in 1887 is authority for the following:

"The cattle of the Alps district are divided into 18 races according to geographical distribution, as follows: Montafone, Lech, L'inn, Wipp, L'Etsch, Rendena, Zillan, Dux, Puster, Moll, Enns, Maltein, Mariahof, Lavant, Murz, Murboden, Styria, and Pinzgauer.

"In Tyrol there were in addition to cows about 30,000 goats.

"In Croatia and Slavonia the milk cows are of the breeds Bonyhad, Pinzgauer, Simmenthal, and Murzthal.

"In Hungary the races were Simmenthal, Bonyhad, Pinzgauer and Montafone. The cows in these districts averaged from 550 to 688 gallons of milk per year with a fat content of from 3.5 to 3.7 per cent."

PRODUCTION AND CONSUMPTION—The total milk production in Austria-Hungary in 1900 was 1,400,000,000 gallons, estimated at 330 gallons per cow. Two-thirds of this production was consumed as milk, butter, and cheese, and one-third was used for commerce. Many of the creameries in 1910 had made much progress but others were still using very primitive equipment and methods. In Tyrol 63,500,000 gallons of cows' milk and 825,000 gallons of goats' milk were produced.

About 90 per cent of the butter and cheese produced was consumed within the country.

AUSTRIA (new boundaries)—The area of the new republic is 32,432 square miles, or 20,750,000 acres. The population in 1921 was 6,500,000. The surface, climate, and general conditions are similar to that of Switzerland and the opportunity for dairying is about equal. Agriculture and gardening occupy about 28.2 per cent of the arable land. The meadows in 1921 covered 2,433,021 acres, pastures 3,282,116 acres, and fodder beets 106,705 acres.¹

The land is worked by the strip method but recently a method has been inaugurated which permits the farmers to get their strips into one plot but at best it is not conducive to dairying. The agricultural products of Austria are not sufficient to meet the needs of the people. The government is attempting to encourage the breeding of dairy cattle (for export) in the upland pastures.

AUSTRIA-HUNGARY (before the war)—The kinds of cheese made in Hungary were as follows: Topfen, Formkase, Ziegelelkase, Olmutzer, Onargel, Liakase, and imitations of foreign varieties or types, as Camembert, Neufchatel, Grevais, Brie, Gorgonzola, Edam, Stilton, etc. Swiss (Emmenthal) and Gruyere are also made in Hungary.

COOPERATION — The first cooperative butter factory was built in 1901. Cooperative societies for the manufacture of cheese in Austria are very ancient. One was established in Vorarlberg as early as 1330. In 1891 there were in the empire about 321 cooperative cheese factories, in 1900 the number became 700, the most of them being in Tyrol and Vorarlberg. The cooperatives of Tyrol, Bohemia, and Moravia have formed a union for the sale of their products and for buying necessary articles on the farms.

The dairy industry in Hungary was quite active. The production of butter was principally for domestic sale. There was in 1910 a condensing plant at Prague.

COW-TESTING ASSOCIATIONS — Cow-testing associations were introduced into Upper Austria in 1904 and in other districts

¹U. S. Department of Commerce Yearbook: Agricultural Survey of Europe, Part 1, Louis G. Michael, Bulletin 1234, U. S. Dept. of Agric.

of the country in 1905. They were called "milk-recording societies," and the records were made three times a week. Associations were found, prior to the World War, in practically all parts of the country.

CATTLE—A special report by Consul Foster, in 1923, gives the breeds of cattle now in the Republic of Austria. The report includes only the principal breeds, most of which were the result of crossing imported breeds with the native stock, as follows:

Pinzgauer—The Pinzgauer is the most numerous and most important breed of cattle in Austria. Its habitat is in the state of Salzburg, East Tyrol, a part of Upper Bavaria, Etyria and Upper Carinthia. The several members are registered in special herd-books. This breed has combined good milking, draught, and beef qualities. It is a red brown with white stripes, and weighs from 900 to 1200 pounds.

Murbodner and Muerstaler—At present the Murbodner is distributed over all North Styria and Middle Styria, and is found in Lower Austria and Carinthia. Its native home is in the Mur valley between Judenberg and St. Michael. The Muerstaler is a native of northwestern Styria. These two breeds are assimilating into one and it is now difficult to distinguish one from the other.

The average weight of these breeds is about the same as that of the Pinzgauer. The Muerstaler is a dark gray and the Murbodner is light or yellow gray. The milk cows of these breeds give from 440 to 630 gallons of milk per year with a fat content of 4 per cent. They make excellent draught animals and fatten well.

Blondvich (Brown Swiss)—The territory of the Blondvich breed is in western Styria. They are known by several names, such as "Marinhofer," "Waldviertel," "Waldviertlervich," and "Kaertner Blondvich." These types vary from 600 to 1200 pounds in weight and the average milk yield is 400 to 550 gallons a year. The fat content is about 4 per cent. They are excellent for beef, milk, and draught.

Graubrennes Gebirge—This breed is raised chiefly in Vorarlberg (Montefoner) and Tyrol (Oberinstaler), Lechthaler (Wipp-taler). Their weight varies considerably, but in Vorarlberg they weigh as much as 1,100 pounds, varying in color from light to

dark brown. The cows average from 600 to 800 gallons of milk a year, with a fat content of 3.5 to 3.8 per cent. The flesh is not good beef.

Fleckvich (Simmenthal)—The Fleckvich breed was developed in Switzerland and imported into Austria and Hungary. In East Styria it is crossed with native breeds and is there known as "Osterreichs Fleckvich." It is also found in North Tyrol and throughout Lower Austria along the Danube and in Upper Austria. In which country it is the largest breed, and weighs from 1,200 to 1,800 pounds. The color is yellow red with large spots. The milk yield is from 650 to 700 gallons a year, with a fat content of 3.5 per cent.

CONDITIONS AT CLOSE OF WORLD WAR—The following from Kallbrunner¹ shows the condition of dairying after the World War:

"In the territory now belonging to Austria the number of cattle continued to increase, although slowly, until 1900; after that year it decreased gradually until the commencement of the war; since then it has fallen rapidly. The number of milk cows in Lower Austria in 1910 was 345,864 head; in 1918, 245,019, a decrease of 27 per cent. In Upper Austria the loss was 17 per cent, and a similar reduction in other provinces.

"This decrease in the number of cattle is due to different causes. Before the war cattle breeding was hindered by frequent epidemics of epizootic apthous fever (foot-and-mouth disease) and by the spread of contagious abortion. The high price of cereals, the low price of milk discouraged milk production. The increasing use of fertilizers made cattle raising appear superfluous from the point of view of manure supply, and caused horses to be substituted for draught cattle. On many farms the cattle were replaced by pigs, which were thriftier and more prolific. A large number of high-mountain pastures were bought by hunters who replanted them with trees and kept them for hunting preserves.

"As a rule, however, it was only the number of cattle that decreased, and not their production. * * * Even when the number of cattle was at its lowest (in 1918) there were more cattle per 1,000 population in Austria than in Switzerland, viz., 333, as against 326.

"In a large part of Austria the cattle are all stall fed, and as milking machines were almost unknown, the greatest cause for decreasing the herds was the shortage of labor and with the primitive methods of handling cattle and storing feed for winter there was no possible chance to resort to machinery or silos, to save labor.

"During the war the milk yield fell to about one-half that of pre-war production. The following is taken from the books of a well-kept establishment:

¹ Kallbrunner, M. H. International Review of the Science and Practice of Agriculture, year XI, months 11-12, 1920.

Average Production of Milk Per Year, Per Cow.

Year	Gallons	Year	Gallons	Year	Gallons
1913-14	792	1915-16	601	1917-18	516
1914-15	738	1916-17	658	1918-19	364

"These data refer to the herd and include dry cows and heifers."

The Secretary of State for Agriculture considered that the average milk yield per cow had fallen from 15 liters to 6 liters a day.

In Vienna, in 1914, with one million inhabitants, the milk received was 990,000 quarts a day, and during the winter of 1919-20 it was only 66,000 quarts but in April, 1920, it had dropped to 33,000 quarts.

The expenses of the industry had increased as well as the greater cost of the upkeep of buildings and the feeding of animals. These all have tended to increase the cost of milk.

The Government, since the war, has proposed a plan for increasing the food supply. This plan includes an increase in the number of cattle to the maximum capacity of the fodder and forage possibilities of the country. "This would mean about 2,700,000 cattle, 1,200,000 calves, 350,000 horses, 2,700,000 swine, 660,000 sheep and goats and 8,000,000 fowls." "The Government also hopes to improve the stock so the annual milk production per cow will be increased from 502 to 582 gallons, and the goat from 93 to 106 gallons."

HUNGARY—(OLD BOUNDARIES)

NATURAL CONDITIONS—The area of Hungary was 68,583 square miles (43,893,120 acres). The surface of the country presented a vast plain sloping down from the Carpathian mountains. The soil of this plain, in some places, is sandy, almost desertlike; in other places, especially along the Theiss river, it is swampy, but in general the soil is fertile. One-third of the soil was covered with forests, one-third was cultivated, and the remainder was in meadows where large herds of cattle, horses, and sheep were reared.

It is estimated that in 1914 55.1 per cent of the population made their livelihood by farming.

The climate has its drawbacks. The winters are often long and severe, and the summers often hot, and droughts are not in-

frequent. However, the country is agreeable, healthful, and adapted to agriculture and stock raising. The average rainfall is from 16 to 30 inches a year.

When that section was first settled is not known, but the Huns overran it in the fourth and fifth centuries, and it was finally settled by the Magyars in the end of the ninth century. They have remained in the country and are the most numerous people of Hungary.

EARLY DEVELOPMENT—The lack of transportation facilities, other than the oxcart, did not encourage trade in dairy products. Little was done to develop the industry beyond home needs and, therefore, dairy products were made and consumed locally. A few kinds of cheese were perfected at an early age. Butter was not used very generally and a market milk supply was unknown. The country was like most countries at an early age except that possibly it was a little more backward. The cattle were more suited to labor and meat production. In fact, no progress was made in dairying until after it existed in other countries of Western Europe.

CATTLE — Until 1890 breeding of cattle was carried on under bad conditions in Hungary but from 1890 the Department of Agriculture became interested and issued directions regarding cattle breeding, conforming to the conditions of soil and climate and following the experiments made in foreign countries. The general plan is given by Bekessy¹ as follows:

"The new aims of the cattle breeder were the transformation of the existing stock by means of the importation of dairy breeds from western Europe. He was to aim at early maturity, milk yield, and the production of beef and manure. This new departure has produced a radical change in the cattle of Hungary in the past 20 years (1894-1914).

"The first foreign cattle were raised in western Hungary and the result gave such satisfaction that this zone became for many years the source of supply for bulls for crossing purposes.

"The cattle bred here were known as the 'Bonyhad' district breed, and were obtained by crossing Kuhland (Moravian) with Simmenthal, but after some years when the breed was perfectly selected and improved, it was bred in pure lines and much prized for its good milking and fattening properties.

"In this region the organization of dairy companies and of cooperative dairies advanced parallel with the extension of the western breed. The produc-

¹Bekessy—Cattle Breeding in Hungary—1914.

tion of forage crops took a considerable place in the rotation; rich manure was obtained and thus the new system of breeding received so great an impetus that this district served as a model to others. By its financial assistance the Ministry of Agriculture also facilitated the purchase of bulls in other districts, where the local conditions permitted the breeding of Bonyhad cattle.

"The importation of cattle to keep up the blood assumed continued increasing proportions. The Ministry of Agriculture defrayed the expenses of the purchases and transportation of these animals and also at times advanced sums for long-term loans without interest. The Ministry gave the assistance of its experts on the occasion of these purchases. Over 3,000 animals were annually imported, mostly from Switzerland and the Austrian Alps. In 1913 2,433 cows and heifers were imported from Switzerland for small farmers. The annual milk yield of these cows exceeded 660 gallons and some gave even 1,320 gallons.

"During that period, 1894-1914, the country was divided into breeding districts for different breeds and resulted in the Simmenthal breed being found in all parts of the country where conditions were suitable for raising a more exacting breed. The old Hungarian breed is still found in Transylvania, where it predominated all other breeds, on account of the extensive pasture lands, but the breed is decreasing annually."

From 1895 to 1911 the population of Hungary increased 14 per cent while the number of milk cows increased 42 per cent. The following table indicates the success of the Government's plan of breeding:

Year	Hungarian breed	Per cent	Spotted breed	Per cent	Buffaloes	Total
1884	3,819,898	78.3	939,493	19.3	119,645	4,879,038
1895	3,756,137	64.5	1,940,303	33.2	132,378	5,829,018
1911	1,872,790	30.3	4,154,442	67.2	155,192	6,183,424

DEVELOPMENT OF DAIRYING UP TO 1914—Dr. Istvan Koerfer, chief of the dairy section of the Hungarian Ministry of Agriculture, wrote a very complete description of dairying in Hungary in 1914, which was published in the *Monthly Bulletin of Agricultural Intelligence*, Rome. A synopsis of the article follows:

"Of late years the Hungarian dairy industry has altered its aims. Formerly it dealt chiefly with the various methods of utilizing the milk that was produced, whilst at present without giving up its old principles it seeks to increase the yield of milk itself."

He then gives a table showing the number and kinds of cows and the milk yield and total production for the year (supposedly 1913).

Production of Milk in Hungary.

Breeds	Number of of cows	Annual yield per cow, gallons	Total yield of milk, gallons
Hungarian, red spotted.....	630,000	198	124,740,000
Simmenthal and Pinzgauer....	700,000	330	561,000,000
Gray Alpine	90,000	396	35,640,000
Buffaloes	90,000	176	15,840,000
Other breeds	290,000	242	70,400,000
Totals.....	1,800,000		807,620,000

"The total exportation of butter, cheese and condensed milk corresponds to 36,029,532 gallons of milk. Comparing these figures with the 807,620,000 gallons of milk produced, it will be seen that the exportations represent 4.46 per cent of the total production.

COOPERATION—"During the closing years of the 19th century there were still many communes (districts) in Hungary in which milk could not be disposed of at anything like profitable prices. This fact induced the Ministry of Agriculture to favor the institution of cooperative dairies. These were at first rather collecting centers than real dairies, the cream being taken to the central station and the skim milk sent back to the members. Created by two joint companies the central dairies are under control of the state, which licensed them. They produced butter of the highest quality.

The first central dairy was opened at Temesvar, in 1899, and the next year others were founded. Three or four years after (about 1904) the organization of these dairies, a certain number of the cooperative creameries, especially the larger ones, were no longer satisfied with the sale of milk but started the manufacture of butter on their own account. At first this venture was very remunerative, when owing to the foot-and-mouth disease (1904) and the lack of fodder, the yield of milk diminished considerably, in both Hungary and the neighboring countries; nevertheless, the foot-and-mouth disease which raged in 1912 revealed clearly that the recent efforts of the cooperative dairies had not yielded good results." * * * "Cooperative dairies do not develop to the extent that would be desirable for the progress of the Hungarian dairy interest. This is to be attributed to the fact that in some parts of the country the small farmer is not convinced of the utility of cooperative dairies." * * *

"The following data are available as to the production of the cooperative dairies.

"Since 1899 cooperative dairies have been founded in greater numbers, in that year 34 cooperative dairies produced 420,759 pounds of butter. At the end of 1913, 573 cooperative dairies were in full activity, turning out 4,730,000 pounds of butter.

"The present tendency is to increase the yield of the cows, which has been judged insufficient. The average yield of the country corresponds to 308 gallons per cow. * * *

COW-TESTING ASSOCIATIONS—"At present milk recording is carried on in 17 societies, in 36 districts, in which 17,000 cows are being tested.

"In each county agricultural society, the section of milk records registers the controlled animals in a local herdbook, and the cows whose yield attains at least 660 gallons during one lactation are also admitted to entry in the national herdbook. * * *"

CHEESE—"Owing to the constantly increasing importation of cheese, efforts also have been made to start cheese factories. Nevertheless, as the foot-and-mouth disease and lack of fodder often hinder the increase of the production of milk, cheese dairying has not yet made much progress. Besides, this branch of the industry requires much more experience and technical knowledge and is more risky than buttermaking, in which progress is clearly noticeable. The recent increase in the consumption of butter is due to the high price of lard.

"The kinds of cheese now made in Hungary are: Hungarian Emmenthal, Trappist, Romadour, and Magarovar, the latter resembling the Tilsitt, a cheese made in north Germany. This industry was introduced into Hungary by Swiss cheesemakers who established themselves in the mountainous part of the country and made handsome profits. Lately these cheesemakers have established their factories, by preference, in the western part of Hungary, because in the south the demand for milk has increased, its price has gone up, and turning it into cheese is not remunerative.

"The Emmenthal and Gruyere cheeses are for the most part made in the dairies at Repcelak, Banco, and Nagyszcseny; the soft, dessert cheeses are made at Sarvar, Pusztodor, and Kisber, and most of the Magyarvar cheese at the cooperative dairies of Monson county. (It is evident that the term 'dairies' may mean butter, cheese factory, or milk plant in Hungary.)"

SHEEP—The number of milk ewes in Hungary is about 3 millions. (In 1913 the total number of sheep was 6,600,000.) Calculating on an average yearly productions of 8.8 gallons per ewe, the total yield may be estimated at 26,400,000 gallons. The ewes' milk is used in the manufacture of Brindza or Lipto cheese, much esteemed abroad. In 1913 Hungary exported 6,214,432 pounds of this cheese.

TRADE—During the last 10 years the exportation of milk and milk products has not kept pace with the increase of the production of milk, which must be due to the increased home consumption of these articles. Only a short time ago, butter, especially in the provincial towns, was used only as dessert, whereas now it has become a popular article of diet.

In Hungary the consumption of milk has considerably increased, especially owing to the anti-alcoholic campaign. The daily

consumption per inhabitant may be estimated as a little over half a pint, or an average of 22.8 gallons each year per person.

COOPERATION—The cooperative dairies in Hungary carried on much of the selling of agricultural products, in view of the fact that they have more than 9,000,000 head of cattle. The co-operatives had from 70 to 75 per cent of all the cattle in their hands, and could sell the milk and milk products at less cost by co-operation. These dairies were not federated in 1910, and were largely milk distributors but made up the surplus, which was generally sold in Vienna. The date of the inquiry giving this information was 1910.

HUNGARY (NEW BOUNDARIES, 1921)

NATURAL CONDITIONS—The present area of Hungary is 36,887 square miles, or 23,607,680 acres. It has a population of 7,945,878, or about 215 per square mile.

In 1921 there were in Hungary 1,646,000 acres of meadows, and 2,501,000 acres of pasture land, or 18.1 per cent of the total land of the country. There were also 1,219,000 acres of forage plants and 1,116,000 acres of tubers and roots, all of which could be used for the advancement of dairying if fed to dairy cattle.

During the years 1911-15 the cattle of Hungary (present boundaries), consumed 3,912,231 short tons of fodder beets. In normal times the production of fodder beets was 13.7 short tons per acre, but in 1921 the production was only 6.2 tons.¹

The number of cattle in the present Hungary, in 1920, was 100,907 bulls, 849,946 cows, 989,663 heifers and oxen, a total of 1,940,516. This means a decrease of about 11 per cent since 1911.

CZECHOSLOVAKIA

NATURAL CONDITIONS—Czechoslovakia has a population of 13,595,716 and an area of 61,922 square miles (39,630,080 acres). Of this total area 6,427,000 acres were in pastures and meadows, and 2,977,000 acres were used to grow root fodders.

¹ U. S. Dept. Bul. 1234, E. C. Michael, The Danube Basin.

The number of cattle and dairy cows is a matter of question, as the census of December, 1920, is admittedly short of the number.

The increase in natural prairies from the pre-war period to 1922 was more than 200,000 acres, and there was about the same increase in pastures. The increase in area under clover in Bohemia, Moravia, and Silicia, has been striking. The average from 1904-13 for that region was 1,215,692 acres and in 1922 there were 1,736,196 acres. The western districts of Bohemia, Moravia and Silicia are hilly to mountainous, with valleys of a fair degree of fertility.

Slovakia merges into the great Hungarian plain and is, in a large part, suited for agriculture and grazing.

Ruthenia lies in the foothills of the Carpathian Mountains and has a very considerable revenue from livestock and forest products.

In the western districts 3,400,000 people are engaged in agriculture; however, the soil is not sufficiently rich and the climate is too severe to make it possible for this number of farming people to produce foodstuff enough to feed the population.¹ In Slovakia 66 per cent of the people are farming peasants.

The Republic may be classed as semi-agricultural; however, 41 per cent of the people till the soil.

CATTLE—Cattle are the principal livestock in Czechoslovakia but sheep and goats also are kept for milk production. The number of cows in 1910-11 in the territory was 2,298,061, being 50 per cent of the total number of cattle. Of sheep there were 1,322,342 head and 711,196 goats.

There are no official returns in existence relating to the production of milk throughout the country, but Dr. Jaroslav Dvorak made some estimates for 1920.² He estimated that the average yield per cow per day, not counting quantities fed calves, may be reckoned at 11 pounds in Bohemia, Moravia and Silicia, and at 9 pounds in Slovakia and 7 pounds in Subcarpathian Russia.

As regards the production of sheep's milk it may be estimated that milk-yielding ewes represent 43 per cent of the total number of sheep and give an annual production of 110 pounds per head. For goats it is estimated that 66 per cent of the total goats supply

¹ U. S. Dept. Bul. 1234, J. G. Michael. *The Danube Basin*. Part 1.

² *Milk and Its Products*, 1924, International Institute of Agriculture, Rome.

660 pounds each yearly. On the basis of these figures and results of the census livestock for 1920 the author gives the following table for production:

	Pounds
Cows' milk	8,158,941,000
Ewes' milk	47,852,000
Goats' milk	540,912,000
Total.....	8,747,705,000

Fully 50 per cent of the milk delivered to dairies is used as fluid milk for consumption.

COOPERATION—The first cooperative movement to appear in Czechoslovakia was between 1850 and 1860. Three men were prominent in promoting these cooperative organizations. Simecek promoted loan banks and urban credit institutions; Chleboard organized cooperative distributing societies among working classes; and Kampelik encouraged mutual saving societies among the needy peasants. Cooperative agriculture began to be important about 1890. The artisans and peasants began to organize cooperatively. This was soon followed by cooperative building associations, which were chiefly fostered by Lostak. Agricultural societies and cooperative dairies followed. Soon the number of cooperatives was very large, as 3 out of 5 farmers were connected with co-operative societies. Other societies were organized, as breeding, sale of livestock, and then came the federation of cooperative societies.

The German cooperatives began in Bohemia in 1895. There was a federation in Moravia in 1893 and in Silicia in 1894.

In 1903 a law was passed making it compulsory for all cooperatives to be inspected by the Government.

The German farmers were slower in their cooperative organizations, as in 1905 there were 138 Czech cooperatives and only 50 German, and in 1922 there were 153 Czech and 94 German societies.

COW-TESTING ASSOCIATIONS—Cow-testing associations were first formed in 1905. In 1914 there were 41 societies with 10,262 cows under test, and in 1922 there were 35 societies with 10,000 cows under test.

YUGOSLAVIA

NATURAL CONDITIONS—The total area of Yugoslavia is 96,064 square miles (61,480,960 acres). The production area¹ in 1922 was 47,434,000 acres, of which 4,093,000 acres were in meadows and 6,895,000 acres in pasture, a total of 10,988,000 acres in grass lands. There was a large increase in grass land in 1922 over that of 1921.

The greater part of the records of Yugoslavia have been destroyed in recent wars and information and statistics are very "patchy." The country is rapidly recovering her normal production of agricultural products and yet it is a new country in that its parts have not been bound together by railroads and regular trade channels.

SERBIA

OLD BOUNDARIES—Feudal conditions prevailed in Serbia from the seventh century to the fifteenth century and serfdom was general, with the church and state owning most of the land. The Turks dominated the land for 400 years, all the land belonged to the sultan, and the serfs had only the right of use. This condition was so painful that farmers often abandoned the land and hid in the mountains. In the wars, 1839-1844, the Turks were pushed back and some of the land was allocated to the peasants and when the Turks were pushed further back in 1878, more allocations of land were made to the peasants.

After the Balkan wars of 1912-1913 no change was made in the land tenure. The early conditions of the peasants in Serbia prevented any material improvement in dairying.

The number of cattle in Serbia was:

1905	969,953
1910	957,918
1911	964,355

The country is well adapted to dairying but the opportunity and the encouragement have not been offered to the people. As late as 1919 all land remaining in the possession of feudal lords was taken over and distributed to the peasants. The state paid the

¹U. S. Dept. Bul. 1234, Agricultural Survey of Europe, L. G. Michael.

feudal lords and the peasants were to repay the state, but the peasants retained the land and refused to pay any dues at all.

ALBANIA

OLD BOUNDARIES, 1914—The area of Albania in land available for agriculture was between 500,000 and 600,000 acres. Before the war the country had a number of very large landowners, and much of the land was owned by the church and state. The peasants' farms were about 25 acres each, whether conducted by tenants or owners. The large estates were usually worked on the share system, one-tenth to the state, three-tenths to the owner, and remainder to the tenant. In southern Albania in 1914 it was estimated that possibly 20 per cent of the arable land was idle, and the agricultural implements were primitive; that is, few of the farmers had modern farm implements.

Livestock raising was somewhat more important than farming but is also conducted along extensive lines. Stabling was unknown before the World War. The horned cattle are represented by the "Illyrian" breed which are small, about 3 feet, 6 inches high, yellowish brown or gray brown in color, and there were also the buffaloes. The buffaloes of the plains are well developed and are, of course, the water buffalo. (See China and India).

In the mountains sheep are found, especially the Zackel type, which supplies the peasants with meat, skins, and milk. Fine, well-developed goats are kept throughout the country.

The grazing lands are extensive but often covered with large ferns and scanty herbage. Meadows are rare and only important in the North. Albania is now a part of the Yugoslavia republic.

GREECE

The total area of Greece (1913) was 15,978,750 acres, divided as follows:

	Acres	Per cent
Cultivated land	3,532,000	22.1
Meadows and pastures	4,990,000	31.22
Forest	2,025,500	12.67
Waste land	5,431,250	34.01
Total	15,978,750	100.00

The high per cent of waste land is explained by the fact that two-thirds of the area is either mountainous and therefore only to a limited extent available for agriculture, or is too poor to be remunerative as arable land.

The average size of the mountain holdings is from $11\frac{1}{4}$ to $21\frac{1}{2}$ acres, while in the plain the farms are from 12 to 25 acres, and in Thessaly their extent is 250 acres or more.

Cattle breeding does not form an independent branch of agriculture in Greece, for cattle are kept mostly for the purpose of turning the arable land to account. Cattle are chiefly bred for draught, the production of milk and meat being a secondary consideration. Among the native breeds are: The so-called Greek breed, distinguished by its light frame and the fine flavor of its meat; the Macedonian, which, except for being somewhat smaller, possesses the characteristics of the Steppes cattle; and the polled Syrian breed.

Goat breeding is much developed, there are more than 3 million head of these animals, or 80 per square mile.¹

The number of cattle, goats and sheep in Greece:

Year	Cattle	Goats	Sheep
1914	300,000	3,547,000	2,638,000
1915	616,000	5,779,000	3,978,000

PRODUCTS—Cheese is produced almost entirely from nearly 4 million sheep and 3 million goats. These animals are the most important part of the animal industry. The goats produce milk from August until the sheep-milking season begins, enabling the industry to continue throughout the year.

The cheese is of two kinds: Slab cheese and cheese brine packed in cases of 50 okes (142.5 pounds). The production of slab cheese for 1912 was 14,000 barrels, equal to about 1,995,000 pounds, and there was also about 2,280,000 pounds of head cheese, a total of 4,275,000 pounds of cheese, according to a consular report. A consular report in recent years gives the following production for 1923—658,352 pounds, 1924, 1,975,050 pounds.

TRADE — The imports and exports of butter before the World War were not heavy but the export of cheese approximated $1\frac{1}{2}$ million pounds a year. The cheese is principally exported to

¹ Mo. Bul. Agri. Intel. P. Pl. Dis. Rome, Year 4, Vol. 6, p. 1009.

the United States. The United States received in 1915, 3,003,-349 pounds of cheese from Greece and the amount was exceeded the previous year. During the war the imports to the United States entirely ceased but began again in 1920 and in 1924 amounted to 1,817,000 pounds.

DAIRY SCHOOLS (Before the World War)

AUSTRIA-HUNGARY MONARCHY

Location	Kind of course taught
Friedland	Agricultural winter school, dairy course given.
Grabnerhof	School of Alpine farming, course in dairying.
Judenburg	Agricultural school, two winter courses.
Klagenfurt	Housekeeping and dairy school.
Kleinhof-Tapiau	School for dairying.
Moravia	School for dairying.
Otterbach	Peoples high school, dairy course.
Rzeszow	Dairy and cheesemaking school.
Bohemia	Short itinerant schools in all parts of Bohemia.
Also-Verecke	Dairy workers' school, practical course.
Also-Verecke	Alpine farm and dairy school.
Croatia and Slavonia.	Dairy course.
Godollo	Dairy school for dairy workmen.
Kisber	Royal Hungarian dairy school.
Magyar-Ovar	Agricultural academy, course in dairying.
Munkacs	Dairy school for dairy workmen.
Nagyszecseny	Special dairy school for women.
Sarvar	Dairy school, short course.

RUMANIA (OLD BOUNDARIES)

NATURAL CONDITIONS — The total area of Rumania was 32,445,600 acres, of which 5,699,215 are occupied by forests, while 18,045,428 are devoted to agricultural purposes and are divided among the various crops. Arable lands had increased at the expense of the pastures. Nearly 85 per cent of the whole arable land was in cereals.

Large estates covered 9,441,986 acres, which was divided among only 5,355 proprietors, some of whom owned more than 12,000 acres each. There were 38,723 meduim-sized holdings of from 25 to 250 acres, occupying 2,131,200 acres. Small holdings account for 7,789,872 acres divided among 920,939 owners.

In 1913 the territory was increased by 2,969 square miles from Bulgaria. In 1919 the meadows were 4,580,267 acres and pas-

tures 7,218,505 acres. The present area is 78,260,480 acres and the population is 17,393,149.

CATTLE—The cattle present chiefly the characteristics of the Steppe breeds. There is a plain and a mountain variety, each of which furnishes excellent draught animals but both are poor for the production of beef and milk.

With more than 1,800,000 cows and buffaloes giving milk it would appear that the country might have possibilities in dairying, but it lacks the organization and development of its breeds of cattle and a market for the product.

SCHOOLS—Agricultural instruction is the subject of special attention on the part of the Government, and is imparted on 20 farm schools. 19 practical schools, and some intermediate schools at Bucharest. The higher branches of agriculture are now taught at the universities.

NUMBER OF CATTLE, SHEEP, GOATS, AND BUFFALOES IN RUMANIA.
(Official sources.)

Year	Milk cows	Total cattle	Sheep	Goats	Cow Buffaloes	Total Buffaloes
1884	.....	2,367,000	4,650,776	244,925	.....	.....
1890	820,510	2,520,380	5,002,390	209,990	.....	.....
1900	701,227	2,588,526	5,655,444	232,515	25,750	.....
1921 ¹	724,653	5,520,914	.....	.....	80,796	200,256
1922	1,682,546	5,745,534	.....	.....	73,155	186,676
1923	1,799,476	5,553,871	.....	.....	73,656	185,280

¹ New boundaries.

BULGARIA — The area of Bulgaria in 1925 was 39,814 square miles, or 25,486,550 acres, of which 9,182,409 acres were under cultivation. The population was on December 31, 1924, 5,033,900.

This country was first created July 13, 1878, but in 1908 it declared its independence and has since remained a free country. Agriculture is its chief occupation and about two-thirds of the people are engaged in the industry. The farms are small being from one to six acres on an average, and their methods and utensils are primitive. The country is not well developed and there are (1923) but 3,912 miles of roads and 1,613 miles of railroad.

The number of sheep in the country in 1920 was 8,922,604 goats, 1,331,853 and cattle, all kinds, 1,877,108.

There has been but little progress in dairying and their cattle are in general similar to those of Hungary and Roumania being of the Steppe variety.

CHRONOLOGICAL EVENTS

- 4th century Huns came to Europe.
 7th to 15th centuries Serbia—feudal lords owned land and serfdom prevailed.
 900 A. D. Magyars settled in Hungary.
 1380 First cooperative cheese factory established in Vorarlberg.
 1500-1800 Turkish dominion over Balkan States, farmers lost all rights to land.
 1839-44 Serbia—farms were allocated to farmers.
 1850-60 Czechoslovakia—first cooperative movement began.
 1878 Serbia drove Turks back.
 1895 Bohemia—German cooperation began.
 1899 Hungary—first central cooperative dairy established at Temesvar.
 1901 First cooperative butter factory established.
 1904-12 Hungary—foot-and-mouth disease epidemic.
 1905 Czechoslovakia—first cow-testing association formed.
 1912-13 Balkan wars.
 1913 Serbia—liberated from the Turks, peasants owned land.
 1914 Hungary—573 cooperative dairies in operation.
 1914-18 World War.
 1919 Serbia—land taken from feudal lords.

NUMBER OF COWS AND TOTAL CATTLE IN AUSTRIA AND HUNGARY

Austria			Hungary		
Year	Cows	Total Cattle	Year	Cows	Total Cattle
1869	3,831,136	7,425,212	1870	2,052,488	5,279,193
1880	4,138,625	8,584,077	1880	2,035,217	5,311,378
1890	4,254,303	8,643,936	1895	2,185,224	6,738,365
1900	4,749,152	9,511,170	1914	2,710,000	.....
1910	4,901,886	9,160,009	.....	.....	.....
1923 ¹	1,074,774	2,162,936	.....	.....	.....

AUSTRIA—IMPORTS AND EXPORTS OF DAIRY PRODUCTS
(Official Sources)

Year	Imports			Exports		
	Butter	Cheese	Condensed Milk	Butter	Cheese	Condensed Milk
	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds
1887	.....	4,108	.....	.....	.....	.....
1891	169	4,176	.....	9,496	1,062	.....
1900	159	7,252	68	12,800	696	.....
1910	3,187	12,537	53	2,912	850	14
1913	14,618	13,201	392	1,724	1,097	222

GOATS

It is the purpose of this sketch to make a general disposal of the subject of goats for all of the countries of the Mediterranean region and adjacent territory.

The principal goat countries, aside from India and South Africa, are found in southern Europe, northern Africa, and western Asia. These countries are semi-tropical and the goats are used for the production of milk, hair, meat, and skins. In all these countries the milk of the goats is used mostly for human consumption as milk, but large quantities are used for the manufacture of cheese and butter. The butter usually exported from these countries is goat butter.

There are three races of goats in this Mediterranean region, the European, Asiatic and African, with many branches.

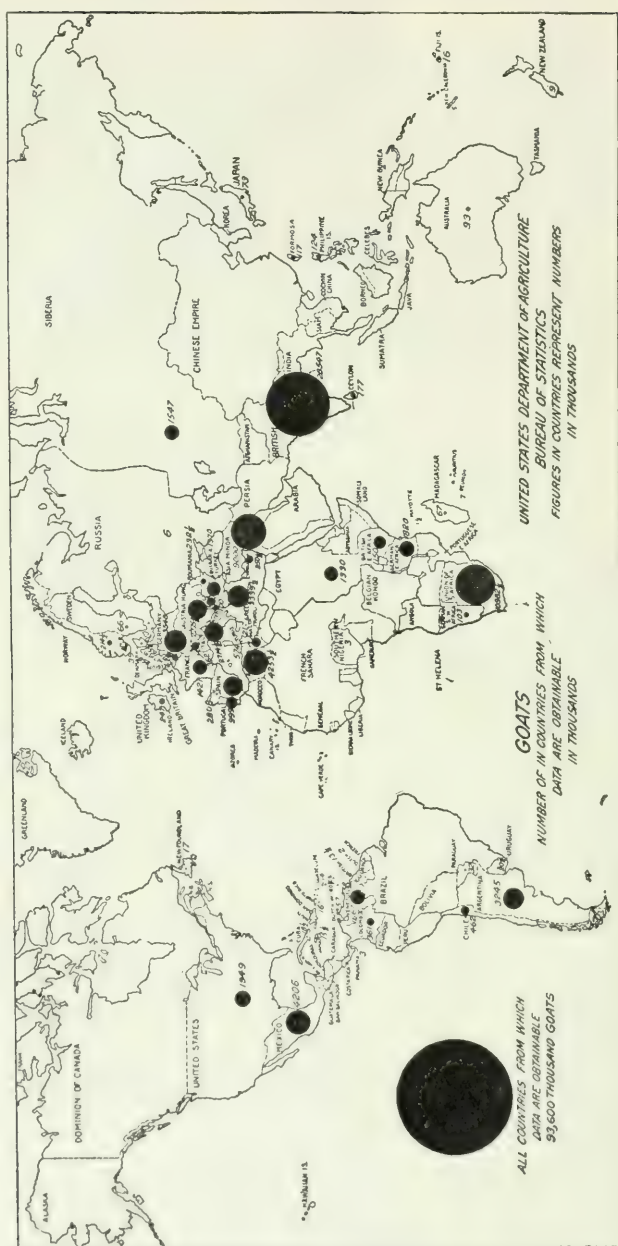
The Swiss Alpine varieties, which are the best products of European goat breeding, belong to the European race. The White Gessenay variety, originally coming from the Upper Simmenthal, has a snow white or cream coat and is usually hornless. These goats yield from $4\frac{1}{2}$ to $6\frac{1}{2}$ quarts of milk daily. The Swiss Alpine goats are usually known as the Saanen and Toggenburg breeds.

The Chamois goats of the Alps are very widely distributed. They live in the Alps of South Switzerland, where they are confused with the Val d'Aosta and Piedmontese goats, which are similar in appearance. These goats are as good for stall feeding as for living in the open and give milk and furnish good meat.

The Lyonese goats of Mont Dore, France, belong to another variety. They live in sheds on farms and their rich, abundant milk contributes greatly to the flourishing cheese industry of those regions.

The Pyrenean goats should also be mentioned, as they are excellent milkers and are generally kept in the plains of Bearn, Basse-Pyrennees, Gars, and Dordogne.

Spain possesses three varieties of goats: those of Murcia, Granada and La Manche. The Murcia goat is large and well shaped. It is a good milker and its milk is noted for high-fat content. This breed has been imported with much success into



Distribution of Goats Throughout the World.

Courtesy of U. S. Dept. of Agric.

Algeria where it has been greatly improved and its milk yield doubled. In France crossing experiments have been made between this Murcian breed and French and Swiss breeds, especially the Gessenay and Nubian goats. Hybrids with fixed characteristics and known as the race of Sainte Genevieve have been obtained. They must be regarded as improved Murcians.

In Dalmatia, Bosnia-Herzegovina, Montenegro, Serbia, Greece and Albania, the predominant variety of goats is one belonging to the European Sanson breed, which differs from all other varieties. These goats are of a mixed variety with very strong and shapely bodies and well-formed udders. They are good milkers and the meat is excellent. The breed is adapted to rugged mountain land, as it is a very thrifty animal.

This same variety is found throughout central and southern Italy, but in the latter region it is mixed with the Maltese breed. The goats of northern Italy belong to the Alpine varieties.

In Turkey in Europe, on the west coast of Asia Minor, in Bulgaria, and Rumania, a variety of goats is kept that belong to the Sanson breed. Their ears are long and pendent like the Nubian goats and horns are generally absent. The breed is generally called the Anatolian.

The Membrine breed is excellent and it also belongs to the Asiatic race, which is found in Syria, Persia, Armenia, Palestine, Upper Arabia and as far as the peninsula of Sinai. There are two varieties of this breed: The Meress or Damas goat, brownish gray, black or white coat, and the Samar goat, including the hornless type known as "Gara." These animals have very long ears, as much as 15 inches. The lactation period is fairly long and the yield of milk is from $3\frac{1}{2}$ to $4\frac{1}{2}$ quarts daily. The milk is used for the making of butter and cream cheese. Aleppo butter is specially prized by the Arabs of Syria. The goats are good for milk, meat and hair. These goats have been imported into Egypt and Algeria and there used for improving the native breed.

The Caucasian goat has a gray, reddish, or spotted coat, and long horns. The milk is richer and more abundant than that of the preceding varieties and is used for making butter and cheese. The meat is excellent but its coat of hair is the most valuable.

The manufacturers of carpets in Anatolia use the hair of this breed of goats.

Of all goats in western Asia, the Aurora is the most improved variety. The milk is abundant and very rich in fat and is used in the manufacture of cheese. Attempts have been made to acclimate them in Europe but with no important success; however, they have been reared in the Union of South Africa, where there are now about 2 million head. These goats have been successfully reared in the United States, in Texas, New Mexico, California, Nevada, Florida, Oregon and Louisiana. Australia has also begun to breed them and have found them profitable.

The native Egyptian is of the African breed. It is hornless, gentle, a large milker, very thrifty and has a flame colored coat with chestnut patches.

The following varieties are found in northern Africa:

Touareges, Fonta Djallon, Sokota, Haoussa (Central Africa). Soufa or Touggourt (E. Sahara), Nubian, Maltese, Libyan, Tunisian, Algerian and Moroccan varieties. The Touareges is valued as a milker. The nubian is a good milker and is regarded as the parent stock of all the goats in the Barbary coast. The Maltese goat is a good milker, giving from $3\frac{1}{2}$ to $4\frac{1}{2}$ quarts a day.¹

¹ Manetti, C. (Int. Rev. of Sci. & Prac. of Agr., Rome, Jan., 1921) and others.

SPAIN.

NATURAL CONDITIONS—Spain is divided into three parts, the southern, the Mediterranean, and the northern maritime, each of which is distinct, especially as to climate. The climate varies from cold to hot, but not torrid. The high table lands of the central region, which is more than 2,000 feet high, has a temperate climate, while on the Mediterranean coast the climate is subtropical. While it freezes hard in Madrid and there is some snow, the mean temperature of the whole of Spain is from 50 to 70 degrees F.

The rainfall is from 15 to 40 inches, but at Santiago it is as high as 66 inches in a year.

The total area of Spain is 48,300,000 acres, of which 683,000 acres are in artificial pastures and meadows (1922), according to the Agronomic Advisory Commission.

CATTLE—According to Morse¹

“The people of Spain and Portugal had a breed or type of cattle before the Aryan race invaded Europe. The same kind was in North Africa, Corsica, Sardinia, and France. Modern representatives are in Spain today. They gradually spread to the east and deviated from the common type. The Celts probably brought cattle to Iberia and crossed them with the native cattle giving rise to the breed now known as Brittany in France, Kerry in Ireland, Welsh Black, Devon, Hereford, and Longhorn of Great Britain, the Duxer and Pinsgauer of southern Germany, and the Piedmont breeds of northern Italy. Some think the Celts did not take cattle with them; anyway the effect on the Spanish native cattle was small.”

There are a number of breeds of cattle of the dairy type in Spain and Portugal, but the principal breeds used for milk are first, the Brown Swiss, then Friesian, Shorthorn, and Jerseys. Aside from these breeds there are the native types the principal of which is the Andalusian breed.

The Andalusian breed may be pure black, pure red, black and white, or even spotted. There is no record of their beginning in Spain and they have been kept pure. Their principal use is for labor and while the yield of milk is given as about 30 pounds a day they are seldom used for milk production. Their housing is most

¹ Morse, E. W., “The Ancestry of Cattle.”

primitive, open sheds being used in general; however, the climate is usually mild. In summer the pastures only are used to maintain the cattle, but in winter their feed consists mostly of tares and chopped straw. Little attention is paid to breeding.

The Galician breed is also important in Spain.

The principal cattle regions are Mancha and Estremadura, where there are about 4,000,000 head of cattle and that is also the principal sheep and goat center.

The principal feed crops are straw, alfalfa, and clover; sugar beets are also raised in immense quantities and the pulp makes excellent feed for dairy cows.

CONDITION OF DAIRYING—A consular report from Mr. A. Wm. Ferrin, Madrid, dated February, 1926, gives much of the conditions and methods of dairying. He says:

"The Association Federal de Cananderoa Del Reino issued the first known detailed figures on the average annual production of milk in Spain, which is given as 1,080,943,891 litres (297,259,570 gallons). This milk was produced by 715,117 cows, 1,609,885 goats, and 3,381,415 sheep.

"The milk was produced as follows:

Cows	220,826,472 gallons
Goats	56,166,344 gallons
Sheep	20,266,754 gallons
<hr/>	
Total.....	297,259,570 gallons

The per capita production of the Madrid district was 10.2 gallons, and the per capita consumption was only 6.8 gallons.

"The average production for the whole of Spain was 13.75 gallons.

"It is estimated that the milk consumption is as follows: Cows' milk, 77 per cent; goats' milk, 77 per cent; sheep milk, 17 per cent.

"Little butter is made in the Madrid district but in some districts there are quantities of milk made into cheese. 'Cafe con leche' (coffee and milk) and rolls is the Madrilenian breakfast, and coffee and milk are consumed freely during the day in the numerous large cafes of the city. The milk so used is as often sheep's milk as goats' milk, but many 'vaquerias' exist dispensing cows' milk over the counter in cans, pails, or jugs, and making also domiciliary deliveries. The service of the goat 'on the hoof' is not performed in Madrid, milking animals on one's doorstep being considered incompatible with the city's prestige as the capital of Spain.

"The sanitary and hygienic character of the milk service of Madrid leaves something to be desired. Outside of Madrid there is little attempt at inspection.

"Cream is not separated and when it is obtained it is from the milk, the skim milk is later sold as whole milk.

"Some condensed milk is made in Spain but not in the Madrid district.

"The cheese industry of the district is largely a household industry; however, there are 17 cheese factories in the district.

"The variety of cheese made is great, from the soft and oily 'tetillia' to the fermented and piquant article of Cabrales. The most famous Castilian cheese, the *Brugales*, takes its name from Bruges, just outside the Madrid district, but the strong sheep's milk, Manchegan, article of Ciudad Real, is a peculiar product of this consular jurisdiction, as are also the cheeses made from the milk of Avila's mountain-climbing goats. Each province has its special cheese, the secret of which it attempts to keep from the others.

"The average amount of milk to the strongest cheese is 4 to 5 liters to one kilogram of cheese.

"No use seems to be made of the residue of milk after the cheese is made except to feed to animals.

"Buttermilk is not sold but there is some sale for sour milk.

"The production of cheese in the district was 14,406,000 pounds (1925)."

GOATS—While cattle are numerous in Spain and are used for milk as well as labor, still the goats of that country produce much of the milk, especially that used for human consumption as milk. This is due to several natural conditions, the rough country which covers much of Spain and Portugal, the climate, and the possibility of getting something from the roughlands by grazing, which lands would otherwise be at least largely waste.

The importance, usefulness and methods of caring for the goats is told by Cavendish¹:

PYRANESE GOATS (French-Spanish border): "In the main goat country, which is around St. Paul de Fenouillet, the villages are perched away in the mountains by the side of a stream, the houses are of terra-cotta, brown with red tiled roofs, but close inspection discloses that the streets are only wide enough to allow the passage of one mule cart and that with careful driving. * * * It all seems to suit the inhabitants as young and old looked most healthy. In these villages almost every cottager has a goat, sometimes two or three; these are housed in the ground floor of the cottage itself which is the kitchen and living room, or in a small outhouse. They are milked early in the morning. At a certain hour, according to the season of the year, an aged goatherd blows his horn in the middle of the village, the goats are then turned loose and run off to him, and he leads the way, the goats following, the dog bringing up the rear, and away they go up the mountain for the whole day. He will have, perhaps, 100 to 500 nannies and kids with him. The goatherd is generally a basket maker as well, so he spends his time making baskets while the goats feed about him. If he wishes to change his pasture or get shade or shelter, he moves off

¹ Brig. Gen. Hon W. F. Cavendish, Norfolk Eng. (Cont. World, Nov. 1924.)

whistling to the goats who immediately trot after him, the laggards being hurried up by the dog. The goatherd invariably leads; he never drives. The hills are covered with rough undergrowth and very coarse grasses and the soil is either too poor or too steep to plant vines or anything useful, but provides ample nourishment for the goats. Toward the evening the goatherd and his flock wend their way back to the village, and as they pass up the streets the goats break off, each one going to her own home where she gets a handful of corn or something she likes, and is milked.

"The goatherd is paid a small sum per goat, per week, and is the authority in the village on all goat matters. They are the goat dealers, sellers, and handlers of all mating arrangements."

These goats are red and probably came from Spain. They are said to give from five to six pints of milk daily.

NUMBER OF CATTLE, SHEEP, AND GOATS IN SPAIN
(Official Sources and International Crop Reporter)

Year	Total Cattle	Total Sheep	Total Goats
1865	2,904,598	22,054,976	.....
1891	2,217,659	13,359,000	2,534,000
1906	2,497,000	13,481,000	2,440,000
1910	2,368,767	15,117,105	3,216,489
1914	2,743,000	16,128,000	3,265,000
1916	3,070,903	16,012,277	3,207,360
1920	3,397,000	16,441,000	3,971,000
1921	3,718,000	19,337,000	4,298,000
1922	3,296,573	.....	3,971,000
1923	3,435,127	.....	3,804,000
1924	3,160,000	.....	3,804,000
1925	.....	.....	.....

Consular report shows for 1925: 715,117 milk cows, 1,609,885 goats giving milk, and 3,381,415 sheep giving milk.

IMPORTS OF DAIRY PRODUCTS
(Official Sources)

Year	Condensed Milk	Butter	Cheese
	1,000 Pounds	1,000 Pounds	1,000 Pounds
1909	4,039	893	4,422
1910	4,506	944	4,882
1911	5,562	844	4,929
1912	6,579	957	5,180
1913	7,336	1,056	5,749
1914	7,757	1,118	5,150
1915	6,679	1,041	3,202
1916	8,203	778	1,465
1917	6,681	561	411
1918	808	300	238
1919	867	254	557
1920	1,675	811	3,735
1921	5,639	624	4,504
1922	83	694	4,222
1923	51	378	5,971
1924	.....	.....	.....

PORTUGAL

NATURAL CONDITIONS—The total area of Portugal is 35,490 square miles (22,713,000 acres). The population in 1920 was 6,032,991 which equals 170 persons per square mile. Portugal has been an independent State ever since the 12th century. It was a monarchy until 1910, and became a republic in August, 1911.

The cultivated areas in cereals, pulse, and pastures was 26.2 per cent of the total, with 49.1 per cent of waste land. In the north maize and oxen are raised, in the mountains rye, sheep and goats, and in the central part wheat and maize (corn).

CATTLE—Dairy cows of the black-spotted breed (Friesian) were imported into Portugal in the middle of the 18th century and still furnish most of the milk for the dairies of the larger cities. These cattle are called "Turina." The cows in adapting themselves to the country have "diminished their lactation period to 225 days, and their yield to 6,270 pounds a year against a 10 months period of lactation and 11,000 pounds of milk a year, as in their original country." On the other hand the fat content of the milk has increased from 3.7 to 3.9 per cent against the average of 3.5 in their old homes. In the neighborhood of Lisbon there are about 10,000 Turina cows which produced, (1914), about 62,700,000 pounds of milk, of which 34,000,000 pounds are consumed as milk and the remainder is made into butter and cheese.

In 1900 the Government passed a decree instituting rigid inspection of all milk and dairy products. Pasteurization is practiced by the principal dairies in Lisbon.

A practical dairy school is at Castello de Paiva.

The total number of cattle is of record but the number of milk cows is not of record. In 1906 there were 703,198 head of cattle and 3,072,988 sheep. In 1908 the number of cattle was 857,000 and sheep 3,150,000.

There are very few figures on dairying of any kind; however, it is known that the milk of sheep and goats is used in Portugal as well as in Spain. Trade figures showing imports and exports are also lacking, thereby indicating that the industry is not developed and that the Portuguese do not appreciate their dairy products.

BELGIUM.

NATURAL CONDITIONS—Belgium is one of the smallest countries in Europe, with a coast line of but 46 miles, however it has very large rivers suitable for navigation. The climate in general is temperate. It has a section of coal land covering 476 square miles. In the east, the soil is partly fertile, and partly sandy and marshy. The only mountains are in the southern part and are not large.

The total area is 7,275,000 acres, of which less than 300,000 acres are waste land. There were 2,202,000 acres of grass land in 1910. The large estates have been subdivided so far that many of the so-called farms are but garden patches of from one to two acres. The smallness of the farms makes it necessary for the farmers to engage also in other occupations. The average farm in Belgium is about $9\frac{1}{2}$ acres. Agricultural machinery is little used but the soil is thoroughly tilled by hand. Every available foot of land is cultivated, rotation is practiced to maintain fertility and to increase the number of crops grown on the same land in a given time. Under the pressure of foreign competition, staple crops of grain are being crowded out. Much attention is given to truck farming, horticulture, seed raising and dairying. According to the War Trade Board of the United States (1914) Belgian production per acre was the highest in Europe and she fed more people per square mile of territory than any of the other countries of Europe; she supported more horses, cattle and pigs than any other country except the Netherlands.

The people belong, in about equal proportions, to two different nationalities, the Flemish and Walloons, but according to language they are divided into three classes, speaking Flemish, Walloon and French. By occupation they are again divided into three parts, manufacture and commerce, 53 per cent; agriculture, 23 per cent; and all others, 24 per cent. It is the most densely populated country in Europe, or was before the World War. The people live in villages, from which they go out to their farms for daily toil and the women and girls perform much work in the fields.

Belgium has been an independent country only since 1831, when it broke loose from the Netherlands. In the time of the Romans the present Belgium was inhabited by Celts and by Germanic tribes, and formed a part of Gaul. During much of the time until 1831 they were under the rule of Austria, France, or Spain; hence, their history and development was somewhat connected with those countries.

CATTLE—There are a number of breeds of cattle in Belgium but the Flemish and Herve cattle are indigenous, while other breeds are either imported or are crosses or grades.

The Black and White Friesian cattle are the most esteemed, but the Flemish is a close second. The Flemish (Cassel or Flamande) is the most numerous in Flanders, their original home, but they may be found in all parts of the country.

Durham (Shorthorn) is preferred in Brabant, but in the Province of Hainault all efforts to introduce the breed have failed, while about Liege it is again found in preference. In Namur the Shorthorn bulls are used for crossing.

After the year 1880 much more attention was paid to the breeding of cattle and great progress was reported. Selection, care of offspring, housing and feeding were the points emphasized. It is a matter of record that while great efforts have been made to introduce the Shorthorn cattle pure it has met with only partial success. About 20 per cent of the cattle are bred for the dairy.

Herve Cattle—The breed of cattle found in that section of the country is without a name. The people have no knowledge of their cattle's origin, but the butter, milk, and cheese of this breed bring the highest prices. It is asserted that King Leopold sent to Herve for butter and cheese from this breed of cattle on account of the quality. It is a small, red-and-white breed not found elsewhere in the country.

There are other cattle of dairy type in the country, such as Jersey, and Bretonnes (Brittany).

Cows are generally milked three times a day, 4 a. m., 11 a. m., and 7 p. m., and are bred to freshen between February 1 and April 1. Any cow not with calf on August 15 is sent to the butcher, thus indicating the extent of culling of the milking herd.

CATTLE BREEDING ASSOCIATIONS (SYNDICATES)—Before the World War the associations, or syndicates as they are called, were the most numerous whose object was the development and improvement of cattle. They were established by the small farmers through the cooperative dairies in order to meet competition.

Two methods were used in the breeding associations; the older judged only the external appearance of the cows, while the other method judged the cow from the economic results. That is to say the one method was on form and the other on performance; however some countries unite the two.

In 1919 the Government decreed that about \$24,000 should be used as grants for animals registered in herdbooks, at \$1.15 a head. The decree also gave financial help to be used for the education of competent judges, supervising herdbook records, awarding prizes for the good maintenance of bulls, and for expenses in ministration. For the cow-testing associations, which were first organized in 1919¹, a sum of about \$5,000 was set aside for the various provinces in proportion to the number of cows in each, provided that none of the money was to be used for cows not registered in the herdbook.

COOPERATIVE ORGANIZATIONS—The dairy industry is one of the most important branches of Belgian agriculture. Under the influence of cooperation it was so greatly developed that the whole Belgian territory was covered with cooperative dairies. Prior to 1890 there were only a small number of rural organizations in the country, and not until 1895 did they assume importance. The causes of this movement were the same as elsewhere; that is, the scientific development of modern agriculture, chemical manure, substitution of machines for hand labor, thus requiring capital exceeding that of the single individual and it also seemed necessary to suppress the middleman in trade. Recent results obtained by scientific breeding encouraged many farmers to enter the breeding syndicates.

The cooperative dairies were especially encouraged about 1890 by the newly invented cream separator which, however, was too costly for a single farmer and several would unite to get the advantage of more cream and more butter from the milk. The Gov-

¹"Le Controle des vaches Laitieres dans divers pays." Int. Inst. of Agric. Rome.)

ernment in 1884 began assisting the cooperatives by offering educational facilities, publishing propaganda, and also by direct assistance. Cheese factories have never progressed so rapidly as the creameries.

The general secretary of the society, A. Collard Bovy, "nationale de la laiterie," states that whenever a cooperative dairy had been established signs of progress were at once apparent. This was true, he said, of all the provinces, especially in Luxemburg. In this province barter had been in common practice, but cooperation enabled the farmers to produce goods of excellent quality which when sent to market found ready purchasers at fair prices. This, in turn, gave the farmers ready money with which to buy fertilizer for their lands, concentrated feeds for their cattle, selected seed for crops, and selected animals to replace less valuable ones.

TYPES OF COOPERATIVE DAIRIES—In Belgium there are five types of cooperative dairies. The oldest, simplest, and most economical is represented by the small "local dairy," in which the milk, brought in daily by the members, is worked by hand. Some dairies have electric power from a central station.

The *regional dairy* is one in which the milk is worked by hand or steam. These have sections in which the milk is separated and every two days it is delivered to the central factory for manufacture. These generally make butter. Regional dairies were numerous before the World War.

The *cooperative creameries* was another form of operation. Each farmer was furnished a hand separator. The cream was separated from the milk at the farms and delivered every two or three days. This system is not generally liked, as the cream delivered was in various stages of ripeness and did not make the best of butter.

The *central steam dairies* is another type of society but is also not very popular as the milk or cream comes long distances and is, therefore, more liable to be delivered in poor condition. The cost is also greater than for some of the other methods.

The *federated dairies* are an advance over the other dairies from an economic and social point of view. An independent society is formed in each district, with its own rules and steam machinery for the separation of the milk and pasteurization of the skim milk

and cream. All the societies are federated and have a central creamery to which every day the cream is brought to be made into butter. The central creamery is only for the making and working of the butter.

A national federation of the Belgian dairies has been established to obtain the purity of produce, and to cooperate for the progress of the dairy industry. They have a control station and an inspection service.

EXTENT OF THE INDUSTRY—Dairying has never held first place in Belgium; however, after the year 1880, when other nations turned to dairying, Belgium gave greater emphasis to her dairying, breeding better cattle, and organizing cooperative societies.

By the year 1908 more than 800 cooperative dairies were in operation. During the year 1898 the total production of milk from cows was estimated to be about 100 million gallons, while the goats and sheep added about 15 million gallons. The consumption of milk as such was figured at 47.3 gallons per person. The remainder was made into dairy products. The exports of butter just prior to the World War were from 2 to 4 million pounds a year, while the imports were from 12 to 14 million pounds.

The cheese exports for the same period were only a few hundred thousand pounds a year while the imports averaged from 30 to 35 million pounds. Hence it is seen that Belgium, with nearly a million cows—one for $9\frac{1}{2}$ persons—could not supply her own needs, and export trade of any importance was therefore not found in Belgium.

During the war the country was overrun and many cattle were slaughtered or carried off, but the number of cows in 1922 was 787,082 as against 936,800 in 1913. The import of dairy products have been heavier since the war than they were before it.

At the present time (1926) dairying is receiving more attention than at any time in the past.

MARGARINE—Before the World War there were 12 factories that manufactured margarine and two manufactured oleomargarine. The number has since been increased to 16 factories while the post-war production has nearly doubled that attained before

the war. The production for the first three-quarters of 1922 amounted to 37,250,000 pounds. The export trade amounted to only 5,500,000 pounds, most of the product being shipped to France and England.

Belgium has a number of dairy schools situated throughout the country as follows: Metecom, Borsbeke, Hansbeke, Heverle, Moorslede, Oplinter, Overysche, Beckheim, Verviers, and Wevelghem. There were also traveling schools and dairy courses in the Royal atheneum and State public schools.

CHRONOLOGICAL EVENTS

YEAR	
1800	Limburger cheese was being made.
1860	Institute of higher agricultural education founded.
1884	Government began assisting cooperative dairy associations by educational facilities, publications, and also directly.
1890	Boerenbond (cooperative journal) established to protect the morale and mutual interests of the peasants, to improve agricultural legislation, and to form guilds or cooperative societies.
1914-18	World War.
1919	Government to grant financial aid to cooperative breeding associations.
1919	First cow-testing association helped financially.
1919	Union Nationale des Laiteries Belges established at Brussels.

NUMBER OF COWS AND TOTAL CATTLE (International Institute of Rome)

Year	Cows	Total Cattle	Year	Cows	Total Cattle
1909	920,534	1,856,833	1920	735,170	1,487,361
1910	964,914	1,879,754	1921	779,966	1,514,953
1911	922,092	1,812,191	1922	787,092	1,516,769
1912	933,928	1,830,747	1923	820,692	1,602,728
1913	936,800	1,894,484	1924	839,076	1,627,655
1919	618,332	1,285,956	1925	.....	.....

IMPORTS OF DAIRY PRODUCTS

Year	Butter	Cheese	Year	Butter	Cheese
	1,000 Pounds	1,000 Pounds		1,000 Pounds	1,000 Pounds
1909	12,719	30,524	1920	18,461	28,093
1910	12,496	31,496	1921	22,663	34,329
1911	15,162	29,642	1922	41,751	48,139
1912	15,225	31,353	1923	21,342	39,548
1913	14,522	35,846	1924	.....	.....
1919	11,177	16,549	1925	.....	.....

THIRD CHAPTER

AUSTRALIA, NEW ZEALAND AND ASIA

AUSTRALIA

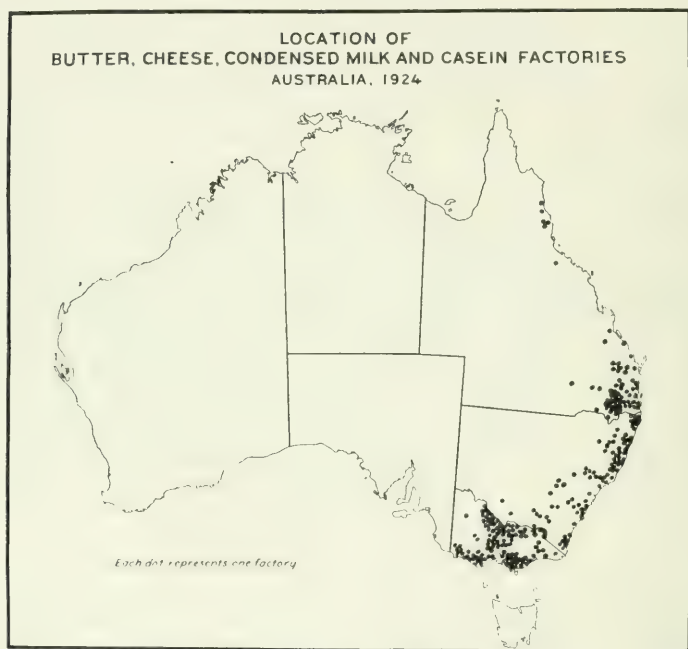
NATURAL CONDITIONS—The area of the mainland of Australia is 2,948,366 square miles, and if Tasmania is included the area is 2,974,581 square miles. The area within the tropical zone amounts to 1,149,320 square miles and in the temperate zone to 1,020,720 square miles. Owing to the fact that there are no high mountains and the depressions in the center, the island is rather low. Beginning at the east, the surface is first a belt of coastal plain, extending along the whole east coast and it is well watered by rivers; its width is often from 60 to 70 miles and averages about 40 miles. West of this coastal plain is the dividing ridge from north to south which turns west toward the southern coast. The descent to the central plain or depression is gradual and part of the plain is below sea level. There is another ridge on the western border of the plain followed by the coastal plain reaching to the west coast. The central plain is more or less a desert and the climate of this desert affects the entire country.

The extremes of temperature in a large part of Australia vary only 81 degrees F.

RAINFALL—On the whole, Australia is a country with a limited rainfall. While on the coast the rainfall is often abundant and the atmosphere is moist, in portions of the interior the rainfall is very limited and the atmosphere dry. Where there are no trees in the interior the air is hot and parched in summer, but along the coast the vegetation is luxuriant. Monsoonal rainfall affects the northern coast in December and January and may continue for several months in a less degree. At Queenstown the average rainfall is 12.7 inches a year. Anticyclone rains occur at all times but generally from March to September and affect the southern area, being responsible at times for floods in New South Wales.

The climate in Queensland is suitable for dairying. The Darling Downs in the south is the principal district within the temperate zone and the climate there is delightful nearly the year

round. The other districts of Southern Queensland are semi-tropical, and the northern part is generally hot. The Pacific districts are as a rule moist and warm; the west dry and hot; and it is only in the south and southwest that frost and cold winds are known. In the western districts the rainfall in some parts is small; on the Darling Downs, which are elevated and lie from 80 to 120



Courtesy of S. Sorensen, Danish Legation.

miles from the coast it is in general sufficient, while in the north coast there is a region of heavy tropical rains where the fall is very heavy.

DROUGHTS—The chief difficulty encountered by agriculture and dairying is the periodic recurrence of severe droughts, which affect all parts of Australia and Tasmania. The damage at times is enormous, but is being lessened by the construction of dams and the sinking of wells. The largest area under irrigation is in the north of Queensland and is devoted mostly to the raising of

sugar cane. The extent of damage can be gathered from the following statement found in *The Dairy Bulletin*, Sydney, dated February 5, 1921:

"The drought was a disaster, inasmuch as it ruined two harvests and destroyed myriads of stock—at least 10 million sheep, half a million cattle, and a hundred thousand horses. No other cause has contributed so much to the suffering of the farmer. * * * In 1818 and 1819 the farmers harvested little wheat and less hay. The Government advanced about £1,330,000 to 10,000 necessitous farmers. So much for wheat growing, but dairying, the most laborious branch of farming, has fared little better."

GRASSES — The pastoral (grazing) industry is very important in Australia, but of recent years much attention has been paid to wheat raising and dairying. The coastal districts provide excellent pasture suitable for cattle and the drier districts of the interior are admirably suited for sheep raising. Stock are fed almost entirely on the native grasses and it is in only a few places that lucerne or some similar crop is grown for the purpose of feeding cattle. One cow it is claimed can be maintained per acre in places.

The pasture lands of New South Wales extend for hundreds of miles, ascending the mountain slopes to the tops and spreading out into vast plains.

Many of the grasses and other herbage have high nutritive qualities; there is no native fodder clover but on the contrary many native leguminosae are poisonous.

In 1896-7 there were more than 800,000 acres sown to grass, and in 1907-8 this area had increased to 2,300,000 acres. In 1924 the area in sown grasses amounted to 4,322,820 acres. The average yield per acre is a little more than one and a half tons.

Green forage is raised in all the states, that is, maize, sorghum, oats, barley, rye, rape, and lucerne, while small crops of sugar cane are also used for this purpose. This crop is used principally with dairying.

CATTLE—This is one of the few countries the beginning of which is well known and all the subsequent developments more or less perfectly recorded. There were no cattle on the island prior to the first English settlement. The livestock which Captain Phillip brought with him when establishing the first settlement in

Australia, in 1788, is stated as comprising 7 horses, 6 cattle, 29 sheep, 12 pigs, and a few goats. The cattle included 1 bull, 4 cows, and one calf.

During the years immediately following the first settlement the growth of the number of livestock was slow, and notwithstanding importations from India and Cape of Good Hope the cattle in 1800 amounted to only 1,044 head. During the next 50 years the pastoral industry made rapid strides and in 1850 the total cattle reached 1,894,834 head. The statistical records of livestock in Australia prior to 1860 are somewhat incomplete but since that time they are quite accurate.

The increases in number of cattle has not been continuous, principally on account of droughts which have left their impress on the cattle.

Cattle raising for slaughter or for dairy purposes, varying with the section, is carried on in all the states. Improved types and breeds of cattle have been gradually introduced for both beef and dairy purposes. In order to manufacture butter and cheese for export trade it was necessary to improve the herds by introducing dairy breeds of high quality. The British Milking Shorthorn has been introduced, in general under private enterprise but the government has at times found it necessary to supervise these importations to prevent bringing disease into the country. The other breeds imported for dairy purposes are the Jersey, Guernsey, Ayrshire, and Friesian. While each of these breeds is in use the Milking Shorthorn is found in greatest numbers.

The annual milk yield per cow varies but may reach as high as 500 gallons (about 5,160 pounds). At first it was estimated that it took 3 gallons (imperial) to make a pound of butter, but now it is estimated that it requires only 2.6 gallons.

As all the types and breeds of cattle found in Australia are imported, no further space need be given to their history, as the history of each breed is to be found in the country of origin. Herds of mixed breeds are rather common and help to account for the low average milk yield of the country. The yield of milk, however, is often for the lactation period instead of the year, and again the calves are allowed to take part of the milk from the cow in some sections; hence the milk yield is not easily obtained.

FEED AND CARE — Permanent shelter is not necessary in Australia. Trees for "shelter belts" are found sufficient for the cattle. "Rugs" or blankets are used during the severe storms in some sections. Owing to the mildness of the climate the heavy expenses of barns and stall feeding are entirely unnecessary. When winter fodder is used it is given the cattle in the fields and consists of oats, maize, rye, barley, and lucerne. Silage is highly recommended for dairy feeding but there are not many silos in any of the states.

Ordinarily the only buildings used are simple milking sheds which the cattle are permitted to enter at the milking time only.



Holstein Cows, Illwara, N. S. W.

Courtesy of S. Sorensen, Danish Legation.

DEVELOPMENT—In general, Australia was strictly a grazing country until beef production did not yield the profits of former times; then there was a gradual swing toward dairying. The progress was slow, as the type of cattle had to be changed from beef to dual purpose or dairy stock. The development of all productive lines was followed by the development of manufacturing lines. As the products were made at a distance of several thousand miles, or several weeks, from the market it was necessary to pro-

duce such products as would hold quality well during the long sea voyage. Therefore, little could be done until refrigeration was in use on seagoing vessels carrying perishable products from Australia. The carrying of ice would have been impracticable.

As late as 1861 the Crown Land Act was passed in New South Wales making available farms from 40 to 320 acres at one pound sterling per acre. The land prior to that time had been held practically entirely for pastoral purposes. The Closer Settlement Act was passed in 1905, and gave permanency to pasture leases, permitting free selection for settlers (homesteads) and offering inducements in the way of easy payments.

There were three principal events which were definite contributions to dairying in Australia. First, the factory system was adopted; second, the cooperative system, and third, the development of an export trade.

FACTORY SYSTEM—The creation of large central factories with many cream stations resulted in cheaper manufacture. The density of dairy farming made large creameries possible. The factories are large, well built, well equipped, and the operators are well trained. Cream grading is required by law and no creamery can be operated without a licensed cream grader at the factory, and the cream grader is responsible to the government inspectors who require definite standards to be maintained. If the cream grader does not maintain the standards he must forfeit his license to grade cream.

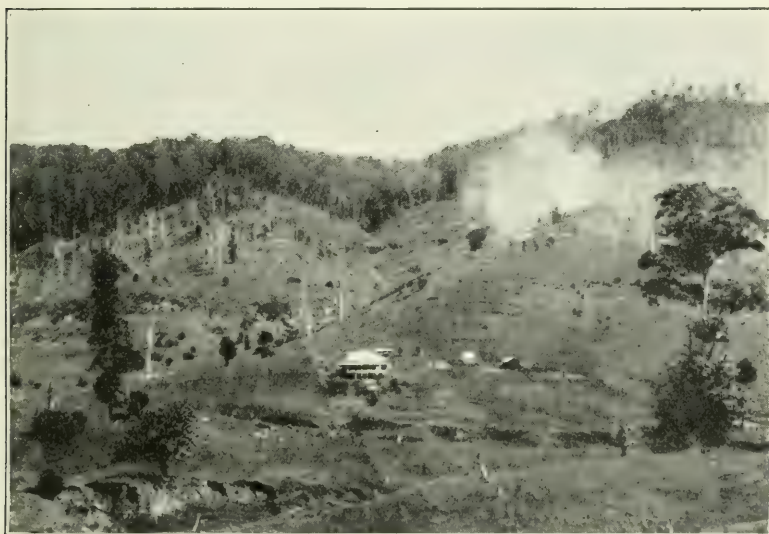
The principal dairy sections are in the southern part of Queensland and in that part of New South Wales lying within 100 miles of the coast. Among the Australian creameries the gathered-cream system is generally used. Very little cream is shipped by rail, the factories limiting their operations to the adjacent territory within reach of motor truck or team.

The first cheese factory in Australia was established in New South Wales.

There is one law in Australia not found in other countries, which provides that dairy factories may be condemned by the inspectors when found to be insanitary or if the building and equipment have been allowed to deteriorate until operation of the factory is uneconomical.

COOPERATION—A great many of the factories in Australia are cooperative (estimated at 75 per cent). The equipment of the factories is similar to that of creameries in the United States or Canada. All the creameries and some of the cheese factories have their own ice machines. The pasteurization of cream for butter-making is becoming universal, and the pasteurization of milk for cheese is the practice.

One of the largest cooperative creameries is at Byron Bay, New South Wales. It was organized in 1895. In 1910 the output was 13,471,536 pounds of butter, and the number of pigs killed was 29,679. The farmers manage the entire business. The com-



Dairy Farm, New South Wales. Developing New Country.

Courtesy of S. Sorensen, Danish Legation.

pany is said to be the life of the whole district and is a fine example of cooperation. The present turnover amounts to \$10,000,000 a year.

The usual method of the early development of cooperation throughout the country is well given in a statement of a single case but the case will fit many other localities:

"The dairy farming conditions in the western district of Victoria were described by Captain Alsop. Less than 20 years ago this land was being sold at

from \$25 to \$50 per acre; today, thanks to cooperation, it fetches from \$200 to \$250 per acre, for dairying. Years ago the butter industry was in the hands of a few proprietary farms. They had small cream-separating stations dotted throughout the dairy districts, and their factories were in the large cities. The dairy farmers sold their milk to the creameries and had to accept whatever the proprietors liked to give. A great deal of speculation in butter was done by business people in the cities, and prices were so irregular that in many cases farmers went out of dairying. Eventually the farmers held meetings and discussed the advisability of forming cooperative companies and erecting their own creameries and butter factories. This was done and large quantities of butter were placed on the market. Proprietary firms still bought and shipped to London; in some cases they acted as agents for the co-operative companies and sold on a commission. But a further development of the farmers took this business also into their own hands. The cooperative companies in a given district combined in order to form a head cooperative selling depot in Australia and in London. Where a selling commission of 5 per cent had been charged by the proprietary firms, the cooperative selling companies found that it was possible, at the end of the fiscal year, to rebate $1\frac{1}{2}$ per cent on the first charge and $2\frac{1}{2}$ per cent."

The factory system as developed in other countries was simply taken over by Australia and factory methods suited to the conditions of the country. These factories were successful from the first and the number increased rapidly and in 1906 there were about 550 factories, mostly butter factories. There has been some increase since that time but much of the development has been to increase the size of the factory rather than increase the number, especially as the system used mostly is the hand separator system.

COW-TESTING ASSOCIATIONS — (Herd-testing societies) — The first cow-testing association was organized in 1908. In 1922 there were 32 associations testing regularly more than 40,000 cows. The cows tested were purebred and grades and included Ayrshire, Red Polled, Jersey, and Shorthorn. The government pays a small sum to cow-testing associations in connection with the record work each year. From the cow-testing work it was estimated that a cow could not make a profit on less than 182 pounds of butterfat per year.

MILKING MACHINES — As Australia is a white man's country and there is not cheap labor enough to supply the demands, there has been, in a way, always a shortage of farm labor and this has advanced the development of machinery for all kinds of work. The milking machines have been one type of machinery used more and more on the dairy farms. The speed of these ma-

chines is wonderful. They are used on a large number of dairy farms. The milking sheds are very simple in construction and are opened only for the cows to enter at milking time. The milking machines are installed in the sheds and the cows are kept in long enough to be milked and then turned into the pasture again. It is usual to give the cow some feed to eat while being milked. A case is cited of 97 cows being milked, the cream separated, and all the utensils cleaned and put away in one hour and 25 minutes. Usually these same cows were milked by three persons and four machines in a little more than two hours.

EXPORT TRADE—When mechanical refrigeration became sufficiently practicable and economical to be used on ocean steamers, it became possible for the dairy industry of Australia and New Zealand to establish a trade with the mother country. The great impetus which this development of the export trade in butter gave to dairying in the Commonwealth led to a considerable and continued increase in the number and quality of dairy herds in each of the states.

This export trade required a general tightening up on the quality of the products exported and the standards were established and legalized. Each of the state departments exercises considerable control over the dairy industry. Dairy experts are employed to give instruction in approved methods of production, to examine animals, to inspect buildings, and to examine marketable produce. A high standard of hygiene and cleanliness is maintained and the purity of products is insisted upon under state laws. Dairying is not, as formerly, all in conjunction with farming, as many of the graziers have turned their attention entirely to dairying.

The following are some of the things which have helped dairying:

1. Introduction of the factory system.
2. Great improvement in dairy equipment and appliances.
3. The establishment of better railroad facilities.
4. The government admitting free of duty materials, except salt, for the manufacture of butter and cheese.
5. Establishing of colleges for the training of leaders.

STANDARDS AND GRADES—Rigid inspection and branding of all butter and cheese for export is required by law, while high

standards have been made for the benefit and protection of the industry. Each factory is registered and receives a number and must be open to inspection by the government at all times. All cream received at creameries must be graded into first, second, and third grades, and these grades must not be mixed for buttermaking. Butter for export must be packed solidly in cubical boxes which must weigh 56 pounds, net. The name and number of the factory must be stamped on the box. The butter is inspected by the government at the freezer (cold-storage warehouse) before it is shipped. This system of inspection and grading of butter has greatly improved the quality of the butter manufactured in Australia in recent years.

Butter for export must not contain more than 16 per cent of water.

Cheese is graded in a manner similar to that of butter. It is practically all of the Cheddar type and each cheese weighs about 80 pounds. Two cheeses are shipped in one crate.

National trade-mark "KANGAROO" authorized in 1924 for 92 score products.

ICE CREAM—Ice cream was introduced into Sydney by Mr. F. A. Peters, of Michigan, U. S. A., about 1908, and the industry has become an important branch, growing year by year, but no figures are available.

CONSUMPTION—The consumption of dairy products is important in Australia and in recent years the consumption of butter per person has been one of the largest in the world. The average is about 25 pounds a year. The per capita consumption of cheese is not large and averages about 3.5 pounds a year. This low consumption of cheese is unusual for people of English descent but may be accounted for partly by the fact that quantities of excellent meats are available at very reasonable prices.

The condensed, or concentrated milk, is unsweetened, the sweetened milk is called "preserved milk." One-half this milk is exported.

For home consumption the butter is put up in pound and half-pound prints. Various sizes of cheese are made for home consumption.

In the delivery of market milk the open containers and the old-fashioned faucet cans are used. Some attempts have been made to adopt the bottle system but with little success.

EXTENT OF DAIRYING — BUTTER—The production of butter shows, in general, for the entire Commonwealth, a steady increase since the drought in 1902, the most marked development being in Queensland. During the years following the World War the production was hampered by the drought conditions; however, in 1924-25 the production of butter again reached a high record. These variations of production are very extensive; for instance, in 1921 the production of butter exceeded that of 1920 by 40,000,000 pounds, and the production for the year 1924-25 was practically twice that of 1923-24.

The droughty conditions lower the average materially; however, the average for the years 1909 to 1918, inclusive, was 169,-962,000 pounds of creamery butter for the whole country. The highest year of record was 1922, which had a production of 267,-072,000 pounds. The butter industry utilizes a little more than 75 per cent of the milk produced in the country.

CHEESE—The production of cheese has not received much encouragement nor does it appear to be so popular as other dairy products in Australia. At the present time the total make of cheese uses about 3.4 per cent of the total milk produced. The total annual production is about 25 million pounds. The production has increased from about 16 million in 1910 to 26 million in 1920.

CONDENSED MILK—The production of condensed milk, sweetened and unsweetened, has increased more than 400 per cent since 1909, when it was only 12 million pounds. In 1922-23 the production was 51,461,000 pounds. This commodity uses only about 2 per cent of the milk produced.

The production of ice cream, casein, milk sugar, and other minor products is principally for home consumption and as the population of Australia is not large when compared with countries in the Northern Hemisphere the production is not large.

The price of land in the best sections of all the states has increased with the development of dairying and some of the land has changed hands at as high as \$500 an acre.

DAIRY SCHOOLS IN AUSTRALIA

Location

- Victoria— Public schools, scientific instruction in dairying.
 New South Wales—Bathurst Experiment Farm.
 Berry Dairy Stud Farm.
 Richmond, Hawksbury Agricultural College and Experiment Farm.
 Pitt Town, Labor Farm.
 Bomen, Murrumdridge Agricultural College.
 Sidney, Technical College.
 Wollongbar Farm.
 Itinerant dairy instruction.
 Queensland— Bundaberg Technical College.
 Gympie.
 Gatton, Agricultural College and Experiment Station.
 Rockhampton, Technical College.
 South Brisbane.
 Toowoomba.
 Tasmania— Bardoe, East Davenport.
 Victoria— Department of Agriculture.
 Burnleu, School of Horticulture (dairying taught).
 Sale, Agricultural High School.
 Warrnambool, Agricultural High School.
 Wtuna, Irrigation Farm.



Hawksbury College, Guards, N. S. W.

Courtesy of S. Sorenson, Danish Legation

CHRONOLOGICAL EVENTS

YEAR

- 320-374 B. C. Known as "Land South of India."
- 1605 Discovered by Louis Vaez de Torres (Portuguese).
- 1688 Rediscovered by the English.
- 1770 Captain Cook made discoveries.
- 1788 First settlement made at Port Jackson.
- 1829 Settlement at Swan River, West Australia.
- 1834 Colony settled in South Australia.
- 1851 Gold discovered.
- 1851 Statistical returns ordered by New South Wales.
- 1855 New South Wales, Victoria, and Tasmania granted responsible governments.
- 1856 South Australia granted responsible government.
- 1859 Queensland granted responsible government.
- 1869 Drought.
- 1877 Drought.
- 1884 Drought.
- 1886 Victoria had 33 cream separators.
- 1895 Drought.
- 1900 Creation of Commonwealth.
- 1902-3 Drought—sheep decreased 18 million, and cattle $1\frac{1}{2}$ million.
- 1908 First cow-testing association organized.
- 1914-15 Drought, severe. World War.
- 1916 Primary Producers' Union organized.
- 1916-17 Partial drought.
- 1917 Australasian Jersey Herd Society founded—also herdbook.
United Purebred Dairy Cattle Breeders' Association founded.
Dairy Producers' Pool organized.
- 1918-19 Drought—destroyed 10 million sheep and $\frac{1}{2}$ million cattle.
- 1919 Milking Shorthorn Association of Australia founded—also herdbook.
- 1922 Drought.
- 1924 National Brand for butter and cheese "KANGAROO" authorized for 92 score products.

NUMBER OF DAIRY COWS AND TOTAL CATTLE
(Australian Year book)

Year	Dairy Cows	Total Cattle	Year	Dairy Cows	Total Cattle
1788	.	16	1913	2,035,717	11,483,882
1792	.	23	1914	1,938,834	11,047,677
1800	.	1,044	1915	1,684,393	9,931,416
1851	.	1,921,963	1916	1,747,351	10,467,737
1861	.	4,039,839	1917	1,904,906	11,956,024
1871	.	4,713,820	1918	1,902,036	12,738,852
1881	.	8,709,628	1919	1,908,536	12,711,067
1891	.	11,112,112	1920	2,055,638	13,449,337
1900 ²	1,143,276	8,640,225	1921	2,343,221	14,441,309
1910	2,064,599	11,744,714	1922	2,419,809	14,336,673
1911	2,120,469	11,828,954	1923	2,304,644	13,357,508
1912	2,056,143	11,577,259	1924	.....	.....

¹ The first importation of cattle was in 1788 and consisted of six head.

² The number of dairy cows is for the year 1899.

PRODUCTION OF MILK AND BUTTER
(Australian Year Book and Bulletin of Production)
(Thousand Pounds—000 Omitted)

Year	Total Milk Produced	Butter		
		Factory	Farm	Total
	Pounds	Pounds	Pounds	Pounds
1901	.	.	.	101,671
1910	572,998	174,228	18,984	193,212
1911	594,727	195,228	16,345	211,573
1912	555,525	171,042	16,152	187,194
1913	583,785	181,386	17,372	198,758
1914	¹	.	.	.
1915	571,778	178,778	15,192	193,970
1916	434,773	121,665	16,008	137,672
1917	549,685	165,039	17,432	182,471
1918	607,363	183,301	17,196	200,497
1919	558,370	165,242	16,561	181,802
1920	529,567	149,847	15,802	165,649
1921	623,275	190,082	18,000	208,082
1922	755,260	247,412	19,659	267,071
1923	685,310	226,666	8,330	234,996
1924	672,532	.....	.....	.....
1925	.	.	.	.

¹ Year changed to June 30, and no figures for 1914.

PRODUCTION OF CHEESE AND CONDENSED AND POWDERED MILK
(Australian Year Book and Bulletin of Production)
(Thousand Pounds—000 Omitted)

Year	Cheese			Condensed and Powdered Milk
	Factory	Farm	Total	
	Pounds	Pounds	Pounds	Pounds
1901	.....	.....	11,576	.....
1910	12,060	4,477	16,537	12,491
1911	12,168	3,719	15,887	22,984
1912	11,946	4,214	16,160	30,060
1913	14,219	5,524	19,743	32,684
1914 ¹	.....	.....	.....	.....
1915	16,667	4,574	21,241	32,064
1916	12,109	3,720	15,829	26,977
1917	21,208	4,201	25,409	45,695
1918	23,907	3,524	27,431	56,188
1919	20,995	2,795	23,790	62,778
1920	23,826	2,370	26,196	66,359
1921	22,668	1,493	24,161	70,944
1922	31,709	944	32,653	70,383
1923	25,381	.....	.....	51,461
1924	.....	.....	.....	.....

¹ No figures for 1914, as year was changed from calendar year to fiscal year.

EXPORTS OF DAIRY PRODUCTS
(Trade Customs and Excise Revenue)
(Thousand Pounds—000 Omitted)

Year	Butter	Cheese	Condensed Milk	Milk Powder
	Pounds	Pounds	Pounds	Pounds
1889	2,363	None	None	None
1890	2,977	.....	.....	.....
1901	34,536	293	.....	.....
1910	87,895	912	267	.....
1911	101,722	1,149	870	147
1912	66,679	146	813	834
1913	75,796	1,603	1,516	1,264
1914 ¹	.....	.....	.....	.....
1915	54,021	2,542	4,766	142
1916	16,722	128	545	164
1917	75,841	10,569	15,237	None
1918	72,278	8,427	25,181	400
1919	41,115	2,303	27,272	663
1920	39,006	7,516	33,406	2,142
1921	92,421	9,530	35,420	1,861
1922	127,347	12,671	33,287	3,391
1923	78,975	5,454	15,841	5,294
1924	65,440	3,831	.....	.....
1925	.....	.....	.....	.....

¹ Calendar year from 1899 to 1913 inclusive, then changed to fiscal year ended June 30. No figures for 1914.



Official Approval for Export.

NEW ZEALAND

NATURAL CONDITIONS—New Zealand is composed of two large islands called North Island and South Island, with a few smaller, near-by islands. The areas are: North Island 44,130 square miles, South Island 56,120 square miles, and other islands 1,611 square miles, making a total of 101,861 square miles, or 65,191,040 acres. Mountains cover about one-tenth of the land, the South Island being the most mountainous.

The population in 1925, excluding Maoris, was 1,325,037.

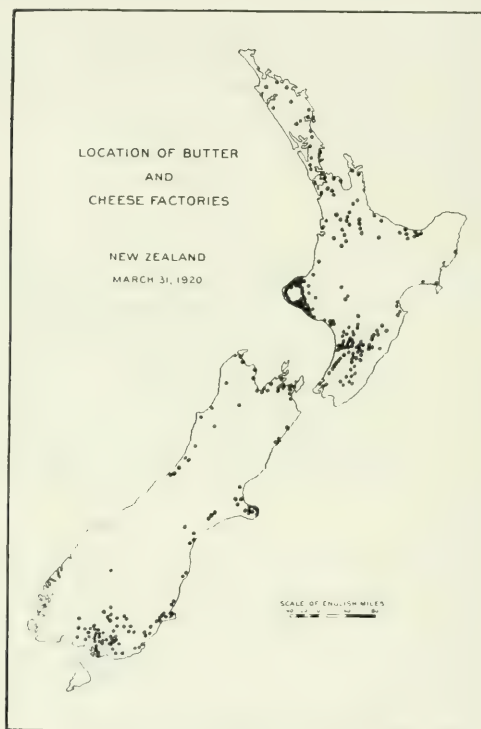
SOIL—The soil covering New Zealand is varied in character, a considerable portion being very fertile, but even the poorer soils are capable of profitable utilization on account of the weather conditions. The soil in Taranaki district is volcanic and has been cleared of trees and underbrush and planted to English grasses.

CLIMATE—The climate at Wellington is said to be about the average of the entire dominion. The average temperature of Wellington is 55° F., the rainfall 48 inches, and the sunshine 2,027 hours per year.

The North Island is subject to extropical disturbances and the South Island to antarctic lows, with prevailing westerly winds. North of Auckland, the climate is nearly subtropical. The west coast has the more rainfall. In the winter months frosts, unknown north of Auckland, now and then occur at night south of that city. In the southern portion of the South Island light snows may fall but do not remain on the ground.

GRASSES—Practically all the grass land in the North Island and most of it in the South Island has been planted from English grass seed. The best fodder grasses flourish and the country has gained a reputation for its pastures. The numerous streams are used for water power as well as for watering stock. The pastures continue throughout the year but must be supplemented during about two months, when the drier part of the year occurs. This is also the colder portion of the year and the cattle are fed on roots and fodder crops. New Zealand is primarily a grazing

country but every year more and more of the land is given over to fodder crops and the stock raising is becoming more and more dairying. Though only 85 years have elapsed since the colonization of New Zealand, 16 million acres of land have been sown to English grasses. A great portion of the crops grown in the



Courtesy of S. Sorensen, Danish Legation.

dominion is for the purpose of producing such commodities as wool, meat, and dairy products. Most of the oats produced are chaffed for livestock feeding. Root crops are grown on a large scale for feeding in winter and for stock fattening, more especially in the South Island. Owing to the comparative difficulty of growing large quantities of turnips free from disease, other stock feeds are coming into prominence. Mangolds are being cultivated to a large extent and farmers are beginning to realize the great value of lucerne (alfalfa). Ensilage making, particularly in the stack

form, is increasing in the dairy districts. A considerable feature of milk-production operation is the growing of green fodder to maintain the milk supply during the drier months. It will be seen that the livestock in New Zealand for the most part is maintained on the products of the farm itself.

In the dairy districts of the North Island alfalfa is being grown in increased acreage, as it proved more satisfactory for cattle feed.

EARLY HISTORY—Prior to the 17th century New Zealand was shrouded in mystery. The origin and date of occupation of the Maoris is unknown. In 1642 the island was discovered by Abel Tasman (Dutch), hence the name, from Zeeland in Netherlands. Captain Cook (English) was the next to see the island, in 1769. The first immigrants arrived in 1840 and founded the settlement and city of Wellington (British).

From the earliest times New Zealand has been dependent upon foreign trade for its progress. Products from seals and whales, then lumber, were first exported. In 1852 the island was given a representative government and a cabinet government in 1856. Dairying was not an industry at that date, as the exports showed for 1853, flax, lumber, wool, grain, and whale oil. Gold was discovered in 1861 and there was a land boom in the 70's. The world depression of prices from 1873 to 1895 seriously affected the country. Since that date the exports of grains have been decreasing and dairy products have been increasing rapidly. In 1862 the first shipment of frozen beef and mutton were sent to London as a trial shipment.

CATTLE—When New Zealand was discovered and occupied by white men, it is said to have had no animals, no fish, and no birds; hence there was no serious trouble in overcoming the native cattle and developing breeds of dairy cattle, as in other countries. The dairy breeds had been developed in the mother country and were simply imported. The English breeds of cattle in the country are: Jersey, Milking Shorthorn, Friesian, Ayrshire, and Guernsey, named in the order of their number in the two islands. The first cattle to arrive were Shorthorn, followed by Ayrshire.

For many years there was practically no dairy industry, as the cattle were used as in all frontier countries, for the farmer's own

family, and then for the growing cities. Not until the depressed prices for small grain in 1880-85 was the subject of dairying given real consideration. The exports show this, as in 1880 only 304,000 pounds of butter and 80,000 pounds of cheese were



Herd of Mixed Breeds.

Courtesy of S. Sorensen, Danish Legation.

exported, which would be the output of about one creamery and two cheese factories. During the next 10 years the production of butter doubled each year and the production of cheese increased 50 per cent annually. The number of milk cows was not even a matter of record in 1880, but in 1898, 20 years later, there were 333,536 milk cows.

There are many herds of mixed breeds and also herds of pure-bred cattle of the dairy types. In recent years there has been much improvement in the dairy cattle but as the breeds have been described in the countries of origin it is needless to describe their development further except to add that the New Zealand dairy breeds are being kept pure and purebred sires are being maintained to improve the breeds.

DEVELOPMENT—Dairying as an industry began about 1880 in New Zealand and since that time has continued to expand over the islands and organize more closely, that is, extensive expansion and intensive organization. Dairying has spread over the land lying below 1,000 feet above sea level, the higher land being generally used for sheep grazing. The land has gradually swung to dairying and tame grasses now cover more than one-fourth of the country. Of the 85,000 farmers more than 45 per cent are dairymen.

FACTORIES — The factory system was introduced in the 80's and became the deciding factor in the introduction of the dairy industry into that country. In 1923 there were 686 factories making butter and cheese, averaging 800,000 pounds for the but-



New Zealand Sheep Lands.

Courtesy of S. Sorensen, Danish Legation.

ter factories and 500,000 pounds for the cheese factories. The style of factories is similar in construction and equipment to those in the United States and Canada but the average output is larger. The methods of operation are also similar to United States methods.

About 95 per cent of the milk produced in the country is used in the manufacture of butter and cheese. The milk and cream when received at the factory are divided into three grades, which must be manufactured into butter or cheese without mixing any two grades. The butter and cheese are shipped to the cold-storage



Cheese Factory in New Zealand.

Courtesy of S. Sorensen, Danish Legation.

plants (freezing plants) where each is scored and the score marked on the package. The butter is then held 10 days before being shipped to market. The butter factories usually operate on gathered cream which is separated on the farms and delivered by the farmers or is collected by the creameries. The number of farm separators in 1920 was 26,678 and in 1923 it was 35,458.

Condensed milk, milk powder, and casein are also manufactured in large quantities.

About three-fourths of the milk used in the manufacture of dairy products is separated on the farms and one-fourth is separated at the factories or the skim stations. All cream is purchased on the basis of the fat test as shown by the Babcock tester.

Farm butter and cheese are still made to some extent, as in 1923-24 5,831,145 pounds of farm butter were made. This but-

ter is consumed locally, and the production is decreasing year by year.

The factory system has been developed continuously as to style of buildings, methods, and equipment. The buttermakers and cheesemakers, despite the fact that New Zealand has no dairy schools and no general system of instruction, are well informed in the technic of their art. There is no law requiring cream grading but grading is almost universal and the butter inspection at the cold storages is a check on the cream grades. Bicarbonate of soda is used to reduce the acidity of cream. All cream is pasteurized by the flash system. Generally two pasteurizing machines are used, each raising the temperature part of the 185° F. required. This method of pasteurization is said to prevent "burnt" flavors in the butter. All the creameries and most of the cheese factories have refrigerating machines. No starter is used in the manufacture of butter (sweet-cream butter) and the churning is done at 46° F.



Cheltenham Factory, Johnerston, New Zealand.

Courtesy of S. Sorensen, Danish Legation.

Cheesemaking is practically as great as buttermaking in New Zealand. Many of the factories are equipped to make either butter or cheese and at times switch from one to the other according to the prospects of better market prices. Nearly all the milk made into cheese is pasteurized and starter added.

Cheese grading was established by law in 1894 (said to be the first in the world). All cheese must be sent to the cold storage warehouse at some port of exit. One crate from each vat of milk is graded and the grades are arranged as first, second, and third. Each crate is then marked with the grade and must remain under the supervision of the inspector until exported. This was the mode of procedure up to the recent pooling of all dairy products for the entire dominion effective August 1, 1926.

The following scores for butter and cheese have been adopted and are in use:

Butter and Cheese Scores.

	Butter	Cheese
Flavor	50	45
Body, moisture and texture.....	25	30
Color	10	15
Salt	10	.
Finish	5	10
	<hr/>	<hr/>
	100	100

The government makes a charge for grading, which covers the cost of the service. No artificial coloring is used in butter. The butter must not contain more than 16 per cent of moisture. The freezing works hold the butter at a temperature of -6° to 10° F. for about 10 days before it is exported. The Auckland Farmers' Freezing Store is one of the largest and has received more than a million boxes of butter a year.

All factories are registered and all buildings and equipment are inspected as to sanitation, water supply, and drainage.

MILKING MACHINES—In no country are milking machines used so much as in New Zealand. Some authorities say that from 60 to 70 per cent of all milk cows are milked by machines. There is little or no stabling of cows, as the pastures are good the year round, but in the winter roots are fed with other fodder on the ground in the pastures. As no expensive barns are used the farmers put up simple milking sheds which the cows are permitted to enter for milking only. A dairy farmer working with two boys can care for 60 or 70 head of cows by using the milking machines. In 1920 there were in the dominion 3,459 double sets and 25,168

single sets of milking machines. The number of cows milked daily by machines in 1922 was 533,345 and a survey showed that 45,819 cows could be milked simultaneously by the machines. There were on the same date only 68,661 persons engaged in the dairy milking plants.

It is said that the dearth of labor is the great drawback to dairying.

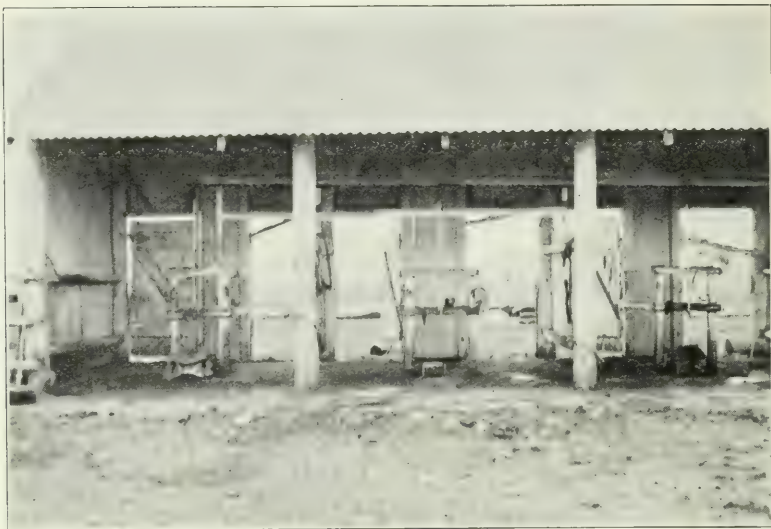
The Dairy Act of 1908 was important in that it provided for inspectors of livestock, and factories, for grading, inspecting, and shipping of all dairy products for export. It provided for the framing of regulations for the registration of dairies, trade-marks, and brands. Authority was given the State to advance money for the purpose of buying land and the erecting of buildings for the manufacture of dairy products. Loans at 5 per cent were to be repayable by half-yearly installments for 15 years. The act provided for the registration of cooperative dairy companies and in certain contingencies it protected the shareholders.

COOPERATION—The story of the expansion of the dairy industry in New Zealand is also an impressive chapter in the history of cooperative organizations. There is abundant evidence that efficient organization on right principles and for proper purposes has been the key to the markets of the world for the New Zealand farmers. Their butter exports to the United Kingdom have increased about 400 times during the last 10 years, and cheese exports have increased nearly 300 times.

In the North Island the amalgamation of dairy factories has been effected in the New Zealand Cooperative Dairy Company with head office at Hamilton. This company controls 59 factories with 8,000 suppliers.

The organization of factories is about 90 per cent cooperative, as the farmers desire to control their own business, but privately owned factories exist and compete successfully with the cooperatives.

In 1923 there were a number of factories which might be classed by themselves. There were: three whole-milk plants, 23 private butter factories, 18 private cheese factories, 7 buttermilk-drying plants, 1 milk-sugar plant, and 4 casein factories.



Milking Shed in New Zealand.



Milking with Milking Machines.

Courtesy of S. Sorensen, Danish Legation.

In 1924 there were 515 factories, of which 460 were cooperative and 55 were privately owned. It is also further shown that the cooperative factories were 80 per cent of the total and made 94 per cent of the butter.

COW-TESTING ASSOCIATIONS—The first cow-testing association was formed in 1909 and from that date the dairy cows began to show an increase in milk production. Singleton says:

"The period during which this improvement in the production of the average New Zealand cow has been brought about synchronizes with that during which the cow-testing movement has been developed. The adoption of this work as an intelligent guide to culling out unprofitable producers and selecting the best as mothers for individuals of the future herd has been of great advantage in attaining the improvement now recorded. * * * The use of purebred bulls of dairy breeds has been a marked influence on the production of our dairy herds, and we believe that the certificate-of-record testing system carried out and given publicity by the breeders and the Dairy Division has been the most potent influence at work in increasing the demand for bulls that will assist in building up the quality of our dairy herds." (Dairy Commissioner of New Zealand.)

The average yield of fat per year is as follows: 1911—141 pounds, 1917—161, and 1922—168 pounds. In 1922-23 there were 77 cow-testing associations in the dominion and 78,578 cows under test. The cows in the cow-testing association in 1923 averaged 245 pounds of fat, which is much higher than the average of the country.

The average size of the herd in 1920 was 39 cows, and the best land maintained one cow to every 2 acres.

TRADE—The process of marketing used in 1914 shows the high standards which were being fixed for the benefit of the industry. Most of these standards are still used.

Each package of butter was stamped on both sides with the churning date and number of vat of cream from which made. When it reached the cold store, it was inspected and graded. While three grades were designated, practically no third grade is found. The inspector issued a certificate to the purchaser and to the factory. The net weight is marked on the box.

Most of the butter and cheese is exported to England, but small quantities are shipped to many other countries.

SPECIAL PRODUCTS—Dried milk is manufactured and at the present time averages from 2 to 3 thousand tons each year. The New Zealand Cooperative Company is the only factory making condensed milk. Another firm makes a dried-milk product, called Glaxo, and the sales reach over a million pound sterling a year.



Skimming Station with Facilities for Drying Casein.

Courtesy of S. Sorensen, Danish Legation.

BREEDING — Three experiment farms are doing scientific breeding of dairy cattle. Herdbook societies have been formed for the different breeds and an official register of merit is maintained.

EXTENT OF THE INDUSTRY—While New Zealand was not settled until 1840 it was not until after the year 1880 that the dairy industry became of importance. The extension of dairying was rather slow for years, awaiting the clearing and grassing down of the land and also awaiting the time when refrigeration on vessels made it possible to export dairy products to England. In the 80s artificial refrigeration became practicable and New Zealand had more than 700,000 cattle, but the number of cows used for milk was not given until 1898, when there were 333,536 head. The number of milk cows increased steadily until in 1924 there were 1,333,000, a gain of a million in 26 years.

The exports of butter and cheese were each less than 5 million pounds a year in 1890 but in 1924 the exports of butter were 143 million pounds and the exports of cheese had grown to 179 million pounds. In addition the condensed milk exports had sprung up to a million pounds and milk-powder exports amounted to 12 million pounds in 1924, while the exports of casein were 5 million pounds.

The exports do not tell the whole story, as the domestic consumption of butter is large in that country, averaging annually about 25 or 26 pounds a person; however, the cheese consumption is rather low, being about $3\frac{1}{2}$ to 4 pounds per person a year.

The imports of dairy products have never been of sufficient quantity to be of interest.

At the present time (1925) New Zealand exports more dairy products than any other country in the world. Its exports form a very important part of the receipts on the great market of the United Kingdom.

A number of factors have united to make the development and extent of dairying in New Zealand rapid and effectual. These factors have been more or less cumulative for that country.

New Zealand had no native cattle to be graded-up, disposed of, or to be replaced by dairy breeds, which saved time. The country was settled and developed after many of the important problems in dairying had been solved. When dairying began in New Zealand the cream separator had been invented, the factory system had been exploited and found to be successful, refrigeration was just becoming practicable, the principal breeds of dairy cattle in England had been fully established and largely developed in milk production, tinware had replaced other utensils, churns were being improved rapidly, and science had finally become interested in dairy products and the improvement of sanitation, pasteurization, and sterilization. All these improvements had been made before New Zealand began its effort to become a dairy country. The importation of ideas, methods, machinery, trained experts, developed dairy cattle was theirs for the taking while other countries had struggled through serfdom, strip-land systems, wars, and vacillating governments, besides being compelled to develop dairymen as well as cattle and markets. The greatness of the extension of dairying in

this country appears to be more in the judgment in the selecting of methods, cattle, etc., which made success simply a matter of time.

From 1920 to 1923 the dairy farms increased in number about 37 per cent and their areas by more than 47 per cent. This growth of dairying has been at the expense of the grazing industry. At the present time 14 per cent of the total occupied land is used for dairy purposes. In 1916-17 there were 3,775,672 acres used for dairying and in 1922-23 it had increased to 6,167,597 acres.

EDUCATION—"The New Zealand Dairy Instructor may be compared with the County Farm Agent in the United States. He is a highly trained specialist in general dairying practice and farm management. Any number of farmers may combine and request the full time services of a dairy instructor, but the government prefers not less than 500 in a group. The government will pay up to one half of the salary of a 500 farm man, whereas it will pay only in proportion to the number of farms less than five hundred. Two hundred and fifty farm group would get only £80 from the government toward the salary. The average salary paid is £320 with traveling expenses running as high as £200 in large associations. The large groups prefer to pay a larger salary and let the instructor furnish his car, thereby avoiding troublesome bookkeeping. The salaries are paid and the apportionments made by the Dept. of Agric. and the association pays its proportion to the Dept., thereby gaining full official standing for the instructor." (Consul Report, March 23, 1926.)

CHRONOLOGICAL EVENTS

YEAR

1769	Captain Cook took possession of North Island.
1770	Captain Cook took possession of South Island.
1840	New Zealand became British territory.
1841	Became a separate colony.
1881	First cooperative factory organized.
1909	First cow-testing association organized.
1922	77 cow-testing associations with 78,578 cows under test.

NUMBER OF DAIRY COWS AND TOTAL CATTLE
(New Zealand Year Book)

Year	Dairy Cows	Total Cattle	Year	Dairy Cows	Total Cattle
1861	193,285	1905	517,720	1,810,936
1864	249,760	1910	633,733	2,020,171
1871	436,592	1916	732,931	2,417,191
1874	494,917	1920	882,854	3,059,445
1881	698,637	1921	993,472	3,112,742
1885	853,358	1922	1,137,055	3,323,223
1890	831,831	1923	1,248,643	3,480,694
1895	1,047,901	1924	1,312,589	3,563,497
1900	372,416	1,256,680	1925	1,320,203	3,503,744

PRODUCTION OF BUTTER, CHEESE AND CONDENSED MILK
(Statistics of New Zealand and Yearbook)
(Thousand Pounds—000 Omitted)

Fiscal Year Ended March 31	Creamery Butter	Whey Butter	Total Butter	Cheese
1896	11,337	.....	.....	9,684
1901	29,758	.....	.....	15,645
1906	51,819	.....	.....	16,807
1911	60,687	.....	.....	53,100
1916	67,619	.....	.....	90,172
1920	62,391	.....	.....	141,444
1921	90,996	1,930	92,926	124,853
1922	132,481	2,529	135,010	142,076
1923	174,016	2,546	176,562	139,775
1924	161,603	3,461	165,064	171,918
1925	.....	.....	.....	.....

NOTE—Farm Butter is not included. It Averages about 5 Million Pounds a Year.

EXPORTS OF DAIRY PRODUCTS
(Trade and Navigation)
(Thousand Pounds—000 Omitted)

Year	Butter	Cheese	Condensed Milk	Casein
1866	26	1	.....	.....
1870	385	306	.....	.....
1880	304	80	.....	.....
1890	3,899	4,531	.....	.....
1900	19,329	11,519	.....	.....
1910	39,932	50,614	236	.....
1915	47,056	91,533	1,175	198
1916	40,167	106,335	984	451
1920	34,945	136,870	1,792	2,975
1921	100,630	153,304	3,029	3,704
1922	125,462	130,053	1,482	3,291
1923	140,016	161,444	1,443	5,632
1924	142,179	178,582	1,408	5,176
1925	.....	.....	.....	.....

TOTAL CATTLE OF PURE BREED
(New Zealand Yearbook)

Kind	Number (1924)
Jersey.....	28,554
Friesian.....	8,177
Shorthorn (both).....	7,288
Polled Angus.....	4,295
Hereford.....	4,234
Ayrshire.....	3,832
Red Poll.....	1,054
Guernsey.....	36
Alderney.....	2
Others.....	16
Total.....	57,488

INDIA.

"Pure milk is a luxury of the rich, whereas it ought to be the common food of the poor."—India.

NATURAL CONDITIONS—India is about 1,600 miles wide, east and west, by 2,000 miles north and south. It contains 1,600,000 square miles and has a population estimated at 300,000,000. It is remarkable for the height of its mountains, the breadth of its plains, and the size of its rivers. The vast peninsula of India is crowded with cities of great size, fertile plains, irrigated and cultivated, deserts, and wild, inaccessible jungles.

The climate varies according to the location, altitude, heat and moisture. In some sections the rainfall is very great, exceeding 100 inches in a year, while other sections are desert. There are, however, many sections with a balmy or temperate climate.

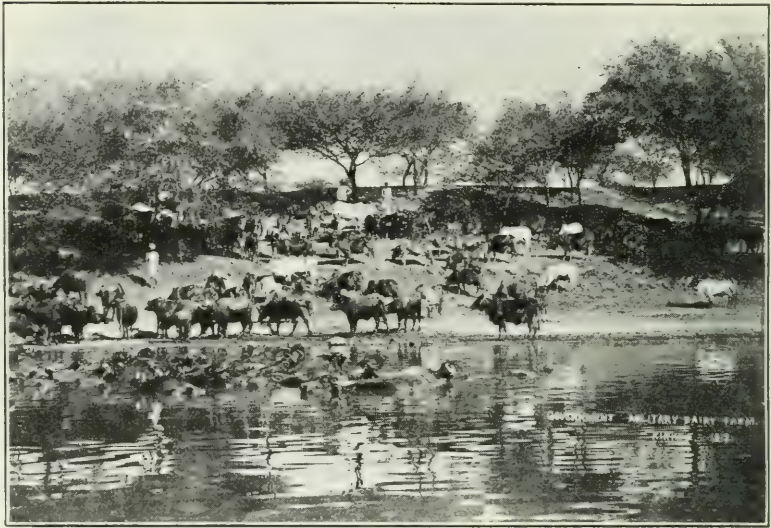
Agriculture has always been the leading occupation. In each province there is a department of land records and a department of agriculture, with staffs of experts whose business it is to promote the industry by means of scientific research and improved methods. Because the country is so largely dependent on the monsoons for rain, the yield of crops varies from year to year. Occasionally famine conditions prevail, but on the whole India is able not only to support herself with all the more important food products but to export tremendous quantities to all parts of the world. The principal crops are rice, wheat, cotton, oil seeds, sugarcane, and tea—any of which would supply some feed for dairy cattle.

More than two-thirds of the population depend upon the soil for their existence. In 1918, 229,620,000 acres, 37 per cent of the total area of the country, was actually cropped. The rainfall is so irregular that about 21 per cent of all the land must be irrigated. Methods of cultivation are extremely primitive in most parts of India.

Most of the grazing country has been conserved into forest preserves or irrigated for grain-producing areas. This reduction of

the pasture lands causes India to do as other countries have done, breed and feed the cattle from the cultivated lands.

PEOPLE — The Aryans, originally from Persia, form the present Hindu race and this race represents 70 per cent of the total population of India. They probably entered India about the time



Herd Milking Buffaloes and Brahman Cattle.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

the Pyramids of Egypt were being built. The Hindus are vegetarians and do not use dairy products to any extent. Cattle are considered sacred in a certain sense and can not be sold, given away or killed, and even the use of cattle in work is more or less objected to by some devout Hindus. There are, however, among the poorer classes, no scruples against permitting the cattle to starve to death through neglect.

The Mohammedans eat most any kind of meat except pig meat, and they consume dairy products.

The European inhabitants of India have trouble in getting properly produced dairy products, and therefore, even they do not consume the usual quantities except as can be provided by their own dairies.

The ambition of the people of India is little above that of 3,000 years ago. A maxim of that date is not out of place today: "Much increase is due to the strength of the ox."

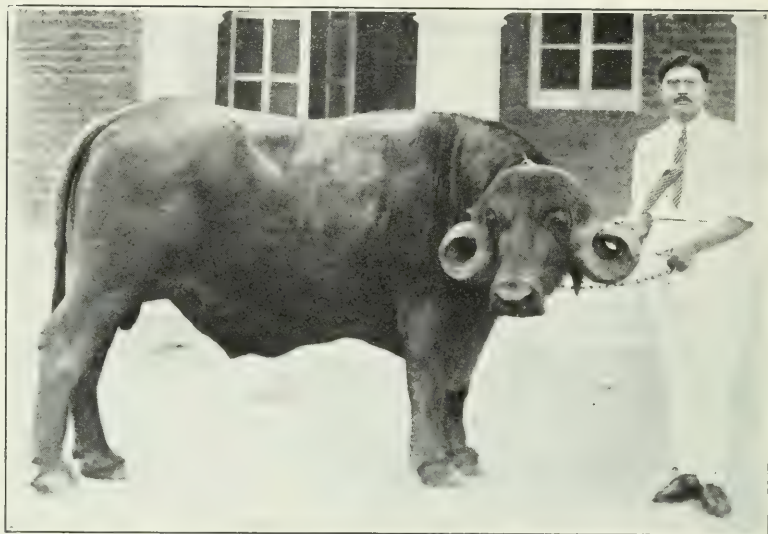
While India is one of the richest countries in the world a large proportion of the people are desperately poor and can not buy the barest necessities of food or clothing.

CATTLE — The earliest word in the Hindu language for monarch means "cowherd," or one who tends cattle, and thus it seems that cattle, now worshiped, must at some earlier time have had a great influence on the lives of the people. The folklore tales indicate the place cattle, especially milk cows, had with the common people far back of written history. Theresa Pierce Williston in some of these tales, pictures it well, as in the story of "The Wonderful Garden of Dreams,"—Little "Your There" early in the morning had to get up to milk the cow. . . . After that she had to take the cows of the village out to pasture and keep them from wandering away." And again in "Little Toe Bone." "He drank all he wished and the rest of the warm white milk he put into his pretty pool. All the sick and hungry animals came to him and he let them drink from his pool and they went away well and happy," . . . and in "Devalapa."—"His work was to take his master's cows to graze by day and to milk, feed, and care for them evening and morning."

When it is realized that these stories were told and retold beyond recorded history it becomes evident that man scarcely knew any existence but that the cow was with him and helped satisfy his hunger with her perfect food.

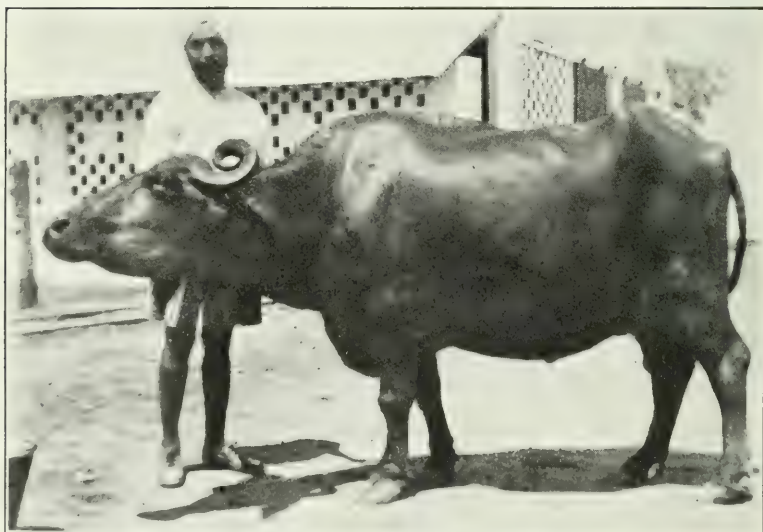
India, including the Native States, has more cattle than any other country in the world and while a great service is rendered by these animals in food and labor, their latent possibilities would certainly prevent famine in that country if they were well fed and properly housed and milked. The latest figures are for the year 1921-22 and indicated the number of cattle, including the zebu and buffaloes, as 179,366,000 but it is possible that the number is even larger than indicated. Cows and buffalo cows numbered 60,599,000.

Of the cattle the zebu and the water buffalo are to be classed as native and there are also numerous imported breeds of European cattle, including Shorthorn, Ayrshire, Brown Swiss, etc.



Buffalo, Milk Breed, India.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.



Buffalo Cow, Milk Breed, Punjab, India.

WATER BUFFALO (CARABAO)—This animal is practically the same as that of China, although it has been developed into a dairy animal more than has been done in China. The buffalo in India is considered the milk cow of that country but is not suited to draft purposes, as it is not able to stand the heat. While it is suited for meat the Hindus do not permit their use in that manner, but the Mohammedans of that country use them for beef as well as for dairying. Buffaloes give milk yielding from 6 to 12 per cent butterfat. The origin of the buffalo is indefinite. Some authors think its home is in northern India, while others think it possible that the Zebu and the buffalo came from the southeast, from the section of Sumatra or other Pacific islands.

ZEBU — The origin of the Zebu is unknown; authors agree, however, that it was common in all India and adjacent countries in its present development and utility at the time of the earliest historical records. It is safe to say that in quantity and quality of milk yield, with few exceptions, there has been no change for possibly 30 centuries in the Zebu. The name "Zebu" is in general use over all Europe, as the designation of the Indian humped cattle, and is not of Indian or African origin, although humped cattle are found in a greater part of Africa and Madagascar.

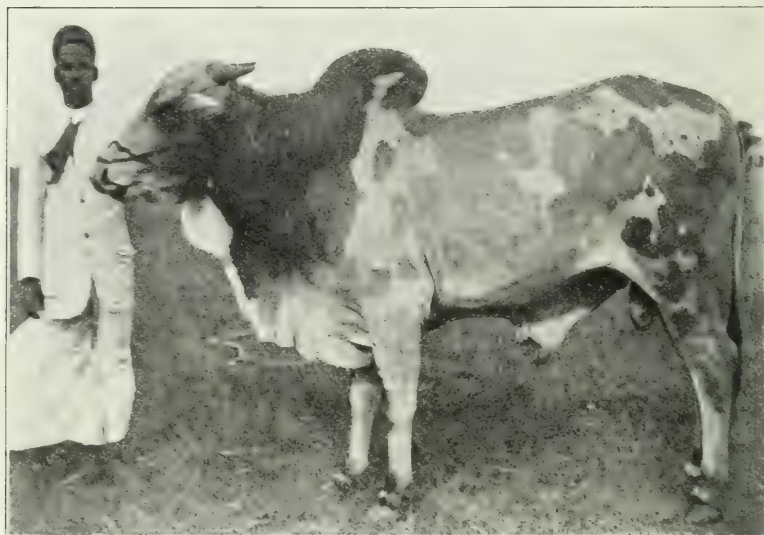
Buffon, a French writer (1749-67), states:

"The whole continent of India, the islands of the South Sea, in all Africa from Mt. Atlas to the Cape of Good Hope we find nothing but humped cattle, and it appears that this breed prevails in all hot countries. These hunched oxen are also swifter, and more proper to take the place of the horse; at the same time they have less brutal natures and are not so clumsy and stupid as our oxen; they are more tractable and sensible as to which way you would lead them." * * * "The hunch does not depend on the conformation of the spine, nor on the bones of the shoulder; it is nothing but an excrescence, a kind of wen, a piece of tender flesh, as good to eat as the tongue of the ox. The wens of some oxen weigh about 40 to 50 pounds; others have them much smaller, as some of the oxen have horns of prodigious size." The same may be said today of the Zebu.

The Zebu differs greatly from other cattle. Its conformation is different, the shape of its ears, the point where the dewlap commences, the manner of carrying its head when at rest, its colors, difference in habits, the voice partaking more of a grunt than a low, and the bulls have more of a roar than a bellow. They seldom

seek the shade and never stand in water. They can maintain themselves in regions infested with tigers. They are practically immune from tuberculosis and the fever ticks.

In southern India there are some wholly white Zebus which take the name "Brahman" as the Brahman priests use them in



Nellore Bull, Dual Purpose, Milk and Draft.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

worship, or they are in a sense considered sacred. In the variations of breeds of Zebu it is found that the names generally are taken from the locality where the type is bred pure or had its beginning.

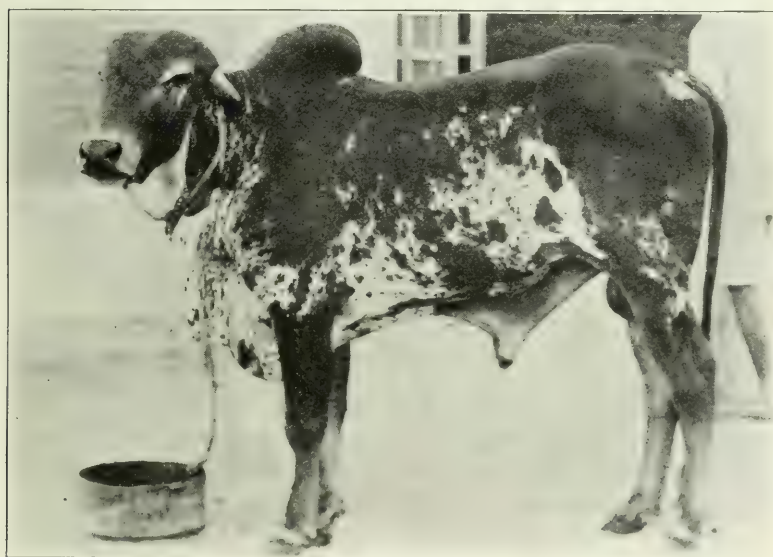
BREEDS—The principal Zebu breeds are: Mysore, Hissar, Gujarat, Gir, Nellore, and Shiwal (Montgomery).

MYSORE BREED—This breed is somewhat deficient in size but is probably the highest class of draft animal in India. They have been bred pure by the Maharajah of Mysore for many centuries. As milkers the cows are noted for the poor yield. A cow of this breed gives about a quart of milk a day; hence the calf can not be deprived of any of it without injury. The calves run with the mothers during the day but at the end of three months begin to graze and are weaned at 5 months of age. Heifers begin to breed

between $3\frac{1}{2}$ and 4 years of age and then produce 6 or 7 calves. Once a Zebu cow starts to breed it is more regular than the English breeds. The annual calf crop in India is 50 per cent of the number of cows (which is very low for any country) and the number of cows per bull is usually about 20.

The Mysore breed has several subbreeds. The color of the breed is iron gray or nearly so but frequently with black hair, while the skin is usually black regardless of the color of the hair. This combination of dark skin and light hair is thought by some to be a partial explanation of their heat resisting powers.

NELLORE BREED—(Ongle)—This breed is found on the east coast of Madras and is the largest in India, often standing about 5 feet high and weighing from 1,800 to 2,000 pounds. The cows give 6 to 7 quarts of milk daily when well fed. Their



Gir Bull, India.

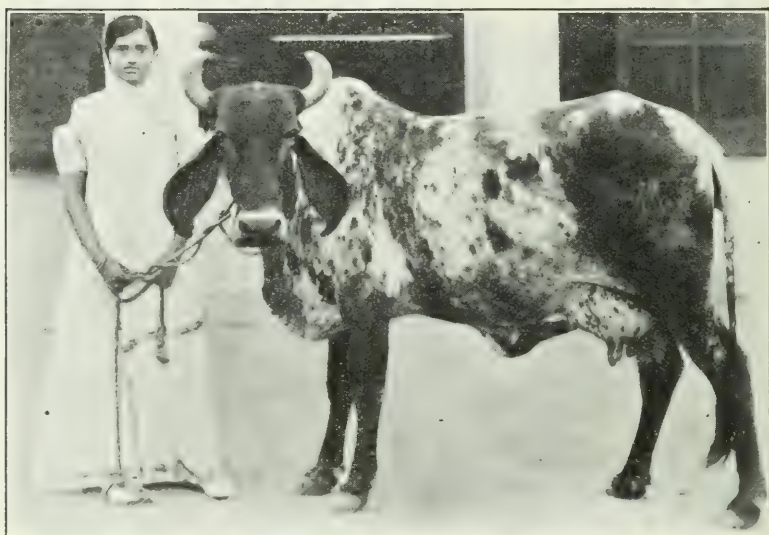
Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

principal defect is their slowness in breeding. They are handsome, docile, and in color black and white, or pure white.

GIR BREED—This breed in its native home has luxuriant vegetation and is grazed the year round. In color the breed is red

and brown blended, or white and brown. The animals are of medium size and are used extensively for milk as well as for beef.

HISSAR BREED—The Hissar breed is of recent origin and was developed for the purpose of drawing artillery and military trains. It is large and of great power, although of slender build.



Gir Cow, Milk Breed, India.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

It seems to be the leading breed in India for milk, giving as much as 4,000 quarts in a year, and averages 11 quarts a day. A government farm at Hissar developed the breed. This farm has 10,000 head for which a herdbook has been begun and the breeding is now done along systematic lines only.

GUJARAT BREED—The Gujarat breed of northwestern India is large, generally dark iron gray in color, and has a very large hump. It is a utility breed but more timid and less tractable than the Mysore cattle but they are equally good milkers and workers. The average yield of milk is about 5 quarts daily.

SIWAL BREED (Montgomery)—The Siwal breed is noted for its good milking qualities and no cow can be registered in the

herdbook with a capacity of less than 4,000 pounds for a single lactation period.

GAINI BREED—The Gaini, or dwarf cattle, are often not more than 3 feet high.

BRAHMANI BREED—Brahmani bulls are black and the cows are generally of a lighter color. The pure white Zebu of southern India are also called "Brahmani."

THE GIR, NELLORE, AND HISSAR breeds are noted for their fine milking qualities and are the best in India. The cows are somewhat hard to break in to milk; at first some have to be thrown to be milked and the cows always object to be being tied while being milked.

Indian cattle are noted for their hardiness of constitution; they can subsist and keep in good flesh on very short grass on which English breeds would starve; they eat many of the coarser grasses and shrubs that other cattle refuse, and are free from tuberculosis. The noted cattle tick does not affect them. They thrive equally well in the hottest lowlands or in the highest mountains; neither excessive heat nor cold seems to hurt them.

The chief cause of loss is from blackleg among the young stock and rinderpest and splenic fever among the mature animals. In the Madras Presidency the total cattle lost from disease for the year ended June 30, 1917, was 65,588 as against 57,472 in the previous year. Of this number 22,268 head died of rinderpest. The total number of livestock in the Presidency was 21,760,402 cattle, including 10,765,543 buffaloes, and 7,426,828 sheep and goats.

ZEBU CROSSES—In tropical climates many attempts have been made to cross ordinary cattle with the Zebu to get the beef-producing qualities or milking qualities of the one with the adaptability of the other to the local climate and its special resistance to disease.

The Madras Zebu is an excellent working animal and the female gives a high yield of milk, 8 to 11 quarts a day; from a cross with Java cattle draft types were obtained but were poor milkers.

By crossing the Nellore Zebu with Australian or Holland cattle animals were obtained which gave a good production of beef and

milk yield which, although less than that of their European dams, was above that of the Zebu, and the hybrids (crosses) were of great value in the warm, damp regions.

By the use of European sires in these crosses the Zebu characteristics soon disappear and in the third generation the progeny can not be distinguished from purebred European cattle.

The Montgomery cow, (Siwal breed) has been mated with an Ayrshire bull with a view to raising the milk yield of the Zebu type. While the Montgomery cow yields on an average from 8 to 11 quarts of milk a day, at the second generation of the cross a daily yield of 16.5 quarts has been obtained.

CEYLON — The conditions regarding cattle and the dairy industry are about the same as that of southern India, though the cattle are subjected to possibly more disastrous effects of rinderpest and foot-and-mouth disease. These diseases are reported to be milder each year, as the Ceylon government is using vigorous methods to stamp out the disease.

The imports of butter into Ceylon in 1913 were valued at \$132,010, cheese imports at \$28,233, and condensed milk at \$183,129.

CONSUMPTION—Dr. E. V. McCollum states in relation to the diet and its effect on the people of this country, that—

"India is a land of many peoples, and these are divided into a large number of sects and races, who inhabit particular areas and engage in very different types of activities in order to subsist. In part of Bengal, where there is a population of 900 per square mile, the diet is principally of vegetable nature. Rice is the chief cereal, but a certain bean (soy?) and other vegetables are eaten in considerable amounts; meat is consumed when obtainable, but the supply is below the demand. Where there is a dense population such as this there can be no great animal industry, for grazing land is necessary for the purpose. Among the hill tribes of India the practice of keeping flocks and herds is common. Where this is true the natives use large amounts of sour milk as food. These are vastly superior to the vegetarian Bengali in physical development. They are cereal, milk, and meat-eating people, but the quantities of milk are not large.

"The western Rajput eats large amounts of milk and clarified butter or ghee * * *. Another group of highlanders in India who are greatly esteemed as soldiers are the Dogra. They live on a diet which is largely cereal and milk, curds, buttermilk, and whey, but eat also considerable fish. The Buddhist does

not try to live on seed products alone, but on those supplemented by a liberal amount of leafy vegetables. He sprouts his seed grains, either the cereals or beans, before preparing them for his table."

BUTTER AND GHEE (Ghi)—Ghee, which is usually made from buffaloes' milk, is clarified butter. The butter is made and then heated for about 12 hours, until the greater part of the moisture has evaporated. In the process of clarification, butter loses about 25 per cent of its weight. Too much heating is said to give ghee an acid taste, while imperfect heating gives a chance for impurities and it is liable to putrify.

Formerly ghee was packed in earthen jars, or for transporting long distances leather cases were used, but in recent years old kerosene cans from America have been used chiefly for that purpose.

One quart of buffalo milk yields about 3 ounces of ghee while the cow's milk yields only about one-half as much. Ghee is also made from goat milk and sheep milk. It is used for all purposes for which butter is used in Europe and America, such as cooking, or on rice or bread. With the poor it is a luxury for feast days, but generally its place is taken by cheap oils.

Ghee is chiefly made in the provinces of Bengal, Rajputana, central India, and the Punjab. By far the greater portion is consumed locally and it seldom is shown in trade returns.

Ghee is easily adulterated and for that reason many people prefer butter.

The manufacture and consumption of ghee in India is not a mere chance; it is sterilized so that it keeps for long periods in hot countries. Butter will probably not displace ghee, it is claimed, as an article of consumption by the native Indians on account of its keeping qualities, ease by which it can be adjusted to grades, and the prejudice against the butter by the ban of religious cast. Some casts are not permitted even to touch an article which a foreigner has touched. It appears, however, that there is a growing demand for butter, not for consumption, but for manufacture into ghee.

A consular report in 1915 indicates that some progress is being made in buttermaking. The following is quoted from the report:

"A dairy expert of the Government Agricultural Research Institute at Pusa, India, states that tinned butter is now largely produced in Gujarat, Bombay Presidency. Despite the absence of a ready market for separated milk, trade in tinned butter has developed considerably and the product is used in India, Burma, and the Straits Settlements. The introduction of the cream separator some years ago has greatly aided the development of this industry. The cream is separated in the villages and sent to large centers like Bombay and Ahmadabad, where the butter is made and tinned. At Bombay the cream ripens on the way and is ready for churning on arrival. The whole process is carried on under insanitary conditions. Still the trade is fairly established and its success is a testimony to the value of an efficient piece of dairy machinery where conditions demand rapidity in handling the product.

"About 1890 the Dairy Supply Co. of London sent a mission to India to report on the possibility of the dairy industry. Several years afterwards, under the auspices of this concern, the first working creamery was established in Bombay."

CONSUMPTION OF GHEE—In the discussion of butter and ghee substitutes the director general of commercial intelligence in 1911 said:

"These oils (coconut, mustard, and gingeli) may be used in place of ghee for culinary purposes but there is no oil in India which will serve as a complete substitute, that is, which may be eaten with rice, as butter or melted butter (ghee) is eaten."

The director further stated in a pamphlet issued in 1908 in connection with the subject of ghee substitute, that—

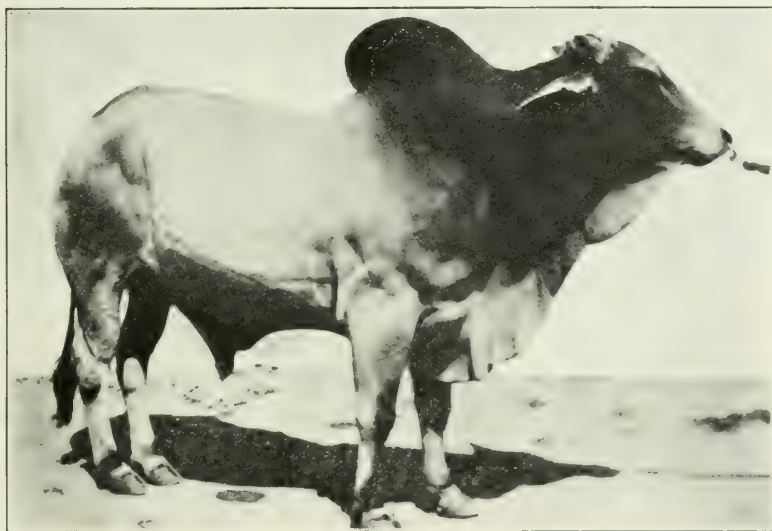
"A reasonable estimate of the number of people in India who are making use of ghee as an article of food would include about a quarter of the total population of 300,000,000, and that the average consumption of those using ghee was estimated at about 8 pounds per annum, or about 267,000 long tons (equal to 720,000,000 pounds of butter). It was suggested, however, that possibly the consumption per head among those who use ghee might readily prove on investigation to be much higher. In the case of the army the daily ration was 2 ounces, which would aggregate 45 pounds of ghee (54 pounds of butter) per year per man. If one-fourth of the population consumed only one-half as much as the army ration, the total consumption must exceed 750,000 tons. In Bombay City, where ghee was subject to duties, so that fairly accurate figures were available, it appears that the consumption by the whole population amounted to 12.17 pounds per head."

In Bombay and Calcutta the consumption of butter is largely restricted to the European community, and although large quantities are made in Bombay, mostly by cream imported by rail from

the Ahmadabad and Surat districts, this is distributed throughout India for European use, or is exported to East Africa and the Straits Settlements.

India also imports a fair amount of butter from Denmark, the United Kingdom, and France, in the order named. The total amount in 1914 was valued at \$142,000. A large proportion of the butter is imported in tins. The imports of butter are not nearly so important as those of condensed milk and cream which amounted to \$1,346,731 in 1914 and \$1,195,991 in 1913. Many natives purchase condensed milk of European manufacture to feed their infants and children.

This increase in the imports of condensed milk into India is largely due to the awakening to the insanitary and dangerous



Zebu, Hissar Breed.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

ordinary milk supplies of India. Some of the residents have the milk cows driven to their doors to prevent adulteration and insanitary practices. Advertising has also helped to increase sales of condensed milk. The condensed-milk companies have advertised very largely in the papers and by giving film shows of the insanitary

methods used in India and the sanitary methods used in Switzerland and Norway.

Burma is the largest consumer of condensed milk in India, with 3.8 per cent of the total population it used 63 per cent of the imports of condensed milk (i. e., 9,307,000 pounds.) This is partly



Indian Purebred Cows, Military Dairy, Kirkee, India.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

due to the fact that the Burmese hardly ever go into dairying. Milk is produced locally by cows and buffaloes kept by Indian emigrants, but the milk is very poor in quality and kept in so insanitary a condition that the Burmese and Europeans prefer canned milk.

MILITARY DAIRY FARMS — The military dairy farms in India are furnishing illustrations of what may be done to get a supply of wholesome milk. Each regiment in the British army in India has its own dairy farm from which milk, cream, and butter are supplied to officers, soldiers, and their families. The cows are carefully selected and kept in clean surroundings, and persons experienced in sanitary dairying are in charge. There has been a considerable outlay in buildings and machinery. The products

are delivered in army wagons in which soldiers are always on duty in order to prevent native drivers from stealing or adulterating the milk.

These military farms, together with the practice of inoculation, have undoubtedly been the means of greatly lessening the prevalence of typhoid or enteric fever among the officers, soldiers, and their families. Among the European troops the sick rate of typhoid or enteric fever has dropped from 20 per 1,000 in 1863 to 2 per 1,000 in 1912, and the death rate, from 5.6 per 1,000 to 0.4 in 1912. As regards children, the death rate, which in 1863 was 90 per 1,000, was only 33 in 1912. Of each 1,000 infants under 6 months of age in 1863, 301 died annually and of those from 6 to 12 months of age 235 died per 1,000. These rates continued until about 1880. While now the mortality is 142 per 1,000 for infants and 73 for children 6 to 12 months of age.

As regards the Indian troops, the mortality shows an improvement of about 46 per cent over that of 1863, as compared with 82 per cent for the European troops.

DEVELOPMENT AND OUTLOOK—The average poor native of India buys only the barest necessities of life, chiefly something to eat and something to wear and a few tools with which to work. In his diet he is usually vegetarian, in accordance with his religion, and his food supplies include mostly various cereals grown in his own country, together with sugar. He also buys for his food when he can afford it, dairy products such as ghee or clarified butter.

In India, including the Native States, there are more than 300 million people and the total number of cattle, including buffaloes, is in round numbers 160 million. If half of the cattle are cows there would be one cow to four persons, or about the same proportion as in the United States. It is estimated, however, that only one-fourth of the people use dairy products; if that is the case then there is one cow to each person who uses dairy products. These cattle are so poorly tended and come so far from yielding their full capacity, which is not a high average, that the quantity of milk in India is very short of what any people should have for health and strength.

A large quantity of ghee is imported and exported each year. The same is true of butter and the quantity of condensed milk imported just before the World War was growing. In 1912-13 the imports were 12,819,910 pounds of condensed milk. The butter imports were 300,000 pounds and the exports 500,000, ghee imports in 1914-15 were 11,789,000 and the exports were 4,900,000, while the cheese imports were 1½ million pounds.

OUTLOOK—After several thousand years the cattle, Zebu, and buffaloes are much the same; however, the British dairy farms have recently demonstrated some of the possibilities in better breeding and feeding of the Zebu. Dairy strains can be produced in the acclimated cattle and their value increased several times. The people seem to be just beginning to realize what dairying as an industry and clean milk as a food would do for India.

Factories are just in their beginning, and imports of condensed milk are having a strong influence in the awakening of the people to the value of dairy products, but no country can progress in dairying faster than it can produce dairymen. India lacks much—transportation facilities, sanitary methods, well-developed markets and a vision of the possibilities of dairying from every angle.

CATTLE, COWS, BUFFALOES, AND BUFFALO COWS IN INDIA
(British India and Native States)

Year	Total Cattle	Cows	Total Buffaloes	Buffalo Cows
1894-5	67,245,000		11,826,000	
1904-5	85,289,000		14,218,000	
1914-15	140,546,000		20,790,000	
1917-18	142,567,000	51,124,000	21,098,000	16,892,000 ¹
1921-22	143,177,000	43,364,000	36,189,000	17,235,000

¹ For the year 1919-20 as Buffalo cows, not reported for previous years.

IMPORTS AND EXPORTS OF DAIRY PRODUCTS

(March 31) Year	Imports of Condensed Milk	Butter		Ghee		Cheese
		Imports	Exports	Imports	Exports	Imports
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
1912-13	12,819,910	313,649	589,762			1,408,991
1913-14	14,681,229	373,756	702,318			1,261,330
1914-15	12,014,282	329,362	551,284	11,789,904	4,939,669	1,393,142
1915-16	9,769,612	176,633	818,311	10,161,200	5,290,992	752,858
1916-17	8,740,996	145,985	1,343,368	8,481,760	5,374,141	876,477
1917-18	6,236,460	40,073		9,106,048		

INDO-CHINA AND SIAM.

NATURAL CONDITIONS—Indo-China, while comprising some 850,000 square miles, has a population of more than 25,000,000. The land is rugged and mountain chains run parallel with the coast. It has large rivers and in the northern province there are vast plains which are well watered. The climate is variable and changes are sudden. The marshy sections are covered with heavy forests, the rivers are large and there are many good harbors. Heavy rains fall during the summer and up to October, after which the climate is pleasant for about three months.

CATTLE—At present the rearing of cattle in Indo-China is far from its possibilities. The stock are of mediocre quality and many regions, though suitable for pasture, have a very small animal population.

In the rice growing sections, great plains of the deltas, the cattle are usually of the draft type and the conditions under which they live is such that they begin to waste away when they arrive in those regions. It is true, however, that while one section of the country consumes the cattle another portion produces them and they do not have to depend on imports for live cattle.

The following official figures for the year 1916 gives the kinds and number of cattle in Indo-China:

Provinces	Cattle			Buffalo		
	Bulls	Cows	Calves	Bulls	Cows	Calves
Cochin-China....	70,528	46,663	18,663	118,691	132,352	46,482
Tonkin.....	75,545	81,410	34,991	141,223	152,813	76,060
Annam.....	95,761	107,368	56,672	69,819	75,352	39,855
Laos.....	131,185	124,678	83,228	148,543	141,813	73,373
Cambodia.....	262,506	163,434	156,509	140,701	128,378	97,254
Total.....	634,525	523,555	289,939	618,979	630,709	334,024

The Grand Total of all Cattle in the Country was 3,031,731.

The chief veterinarian of Tonkin states that the number of cattle in Indo-China increased only 5 per cent even though the birth rate is much higher. There are three risks in this region—flood, drought and epizootics. The cattle plague occurs every six

or seven years and is very severe at the beginning but gradually diminishes at the end.

The farms operated by Europeans have corrected many errors in breeding and care of livestock, but also made mistakes for which they paid dearly. At the present they are trying to get half-breed or good native cattle, with large frames, for the coffee plantations, and the dairy farms require one-half to a quarter of imported blood which yield more milk but require more attention. The first pure-bred animals came from France and Australia. The Hindu breeds are only in small number although they possess fine qualities.

These various crosses were, at first, made in order to start a dairy industry which has always been needed, and now more than ever. Breeders realize that they must not try for too much European blood, as animals having one-quarter of imported blood are the only ones that seem to permit an improvement of the breed while maintaining the hardiness required. The tendency is toward the importation of Hindu stock for the grading of native cattle to improve both beef and dairy qualities.

CONSUMPTION—Siamese and Chinese in this country depend on canned milk as far as they use milk at all. The Siamese children are not weaned until they are 3 years old; hence very little milk is used. Although a few cows are kept in Bangkok they are for the use of the principal hotels, and the European residents are able to obtain fresh milk in small quantities. In the interior canned milk is used for invalids and infants, although the Siamese as a people use very little milk.

JAPAN.

NATURAL CONDITIONS—Japan consists of four large islands and numerous small ones, nearly 4,000 in all, having a land area of 147,669 square miles. A great part of the land is hilly, of volcanic origin, and not suited to crops but could be turned into pasture lands. The population in 1919 was 57,070,000 or about 375 per square mile.

The climate is variable but as a general rule the central and most densely settled portion is mild and agreeable. The southern part is often hot and oppressive. In the month of September there is usually rough weather as it is the typhoon season. The remaining months of the fall are the most pleasant of the year. Japan is a land of earthquakes and has been visited by a number of very destructive ones.

The people of Japan have been led from dairying rather than toward it, except in recent years, but their characteristics as a people are admirable for that industry, as they are industrious, contented, and have an ambition to excel.

EARLY HISTORY—The history of Japan covers 25 centuries with its beginning lost in tradition, its early age filled with internal strife, and its latter years brilliant with success and achievements in all lines of human endeavor.

After the introduction of Buddhism (A. D. 552) the slaughter of animals was forbidden under severe penalty. It also prohibited the eating of animal products, including milk and butter but not fish and eggs. Before the Buddhists came to Japan, cow's milk was a well-known food but was little used and that only by the more wealthy class.

There was little change in these conditions until after the country was opened to the trade and contact with other countries—that is, after the year 1870. Since that time the Japanese have imitated the habits and methods of America and Europe in food, dress, and in the various industries. Not the least of these the introduction of dairying.

CATTLE — Japan has really three kinds of cattle, native, imported, and grades. The native cattle of Japan are small and hardy and yield a very small quantity of milk. For centuries they were used only for draft and labor. They were poorly fed and housed; hence it was no wonder that they more nearly resemble wild cattle in the milk yield and flavor of their meat. The Japanese consider the meat of native cattle much more palatable than that of the domesticated imported cattle.

In 1900 there were in the country 1,261,000 head of all cattle; of these 676,000 were native cows, 83,000 were grade cows, and 15,000 were cows of foreign breeds. The first record of the number of milk cows was in 1909 showing only 47,714 head with an average of 2,581 pounds of milk a year. The number of milk cows has but slightly increased up to 1922 but the yield of milk has been brought up to 3,303 pounds.

The first improvement in the native cattle was the introduction of Friesian sires from Holland, Ayrshire bulls from Scotland, and Brown-Swiss bulls from Switzerland. At the present time (1925) the foreign breeds are bred pure and grades are to be found all over the islands. There are numerous associations for the improvement of the native cattle.

The total number of cows furnishing milk for the industry is not of record but it has been estimated at 100,000 head, of which 50,000 furnish milk for human consumption as fluid milk. This scarcely gives each person one and one-third quarts a year.

The cattle are fed on grass and rice straw principally as silage is seldom produced; however, the concentrates consist of wheat bran, rice bran and tofu (soybean cake).

The first cow-testing association was organized in 1911, and in 1922 there were 15 societies with 463 cows.

There were also, in 1916, 81 societies for the improvement of stock and dairy farming.

DEVELOPMENT—The food of the Japanese is mainly vegetable, and rice has the first place. Meat is very high in price in that country. Fish and rice is the principal food of the people but there is a tendency to turn toward the meat products and also dairy products. Few Japanese like the smell of cheese, says one author, and therefore, little of it is used by them; however, the cheese made

from soybean milk has very little smell and is used extensively throughout the country. It is used raw or cooked and may be used with rice. The soybean cheese does not contain so many vitamins as does the soybean milk. Eggs from China are also an important food in Japan. This is another source of vitamins. Rice contains vitamins but the unpolished contains the more vitamins.

The custom, established by the Buddhists against eating meat and dairy products, is being abandoned rapidly and the people are consuming more and more dairy products. They have found that it is necessary for the nourishment of the children that they should have animal protein and this has helped change the custom.

Professor Hashineoto, in 1913, gave some of the reasons why dairying developed slowly in Japan, which were as follows:

"After the introduction of Buddhism the slaughter of animals was considered a sin.

"Comparatively the country is more thickly populated than any other civilized country, so that the entire area of fertile soil is cultivated and there are few pastures and meadows.

"The country is surrounded by oceans. Fish are abundant as a source of protein supply.

"Tofu, made out of soybeans, is an economical, digestible food high in protein and is widely made by farmers and tofu makers throughout Japan.

"The native cows are very poor milkers."

Butter is generally made by small milk dealers; however, several cooperative creameries have been organized and are making good butter. As usual the skim milk is returned to the farmers for the calves. The production of butter in 1915 was 683,000 pounds while in 1922 it was 1,205,000 pounds.

The production of condensed milk to meet home demands is one dairy problem that is receiving much attention. In 1915 the production was 4,866,000 pounds while in 1922 it had increased to 15,708,000 and the imports commodity were larger than ever, with practically no exports. For reasons heretofore mentioned the manufacture of cheese is receiving little attention at present.

The total production of milk as reported annually by the minister of agriculture shows remarkable increases. In 1909 the production was 96,478,000 and in 1922 it had more than doubled, being 216,031,000 pounds.

TRADE AND MARKETS—Japan has such a dense population and so little land for pastures that it seems impossible that they will ever supply their own people with dairy products when they consume quantities equal to European peoples. It would take 10,000,000 dairy cows, each giving 6,000 pounds a year, to furnish the Japanese people with as much milk as is consumed per person annually in the United States. Many, therefore, must do without milk for years to come.

The demand is already far in excess of the production and dairy schools and colleges are endeavoring to increase the quantity by all scientific means known. As the consumption of whole milk is low it is significant that the importation of condensed milk is important. In 1902 the imports of condensed milk amounted to 4½ million pounds, and the production in 1903 (first year available) was 338,000 pounds. In 1912 the imports of condensed milk were 10,358,000 pounds and the production in 1922 was 15,708,000 pounds, with no exports. Thus it is seen the condensed milk consumption has grown from practically 4,800,000 pounds in 1903 to 27,960,000 pounds in 1922.

The imports of butter in 1906 were 157,000 pounds and the production amounted to some 44,000 pounds, making a consumption for that year of 201,000 pounds. In 1922 the butter production was 1,205,000 pounds and the imports were 777,000 pounds (including artificial) making the consumption for that year approximately 1,982,000 pounds.

The imports of cheese amount to approximately 50,000 pounds and is principally all consumed by the foreign residents.

MILK MARKET—It is estimated that 80 per cent of the milk produced in Japan is consumed as fluid milk and that largely by European and American residents and for baby food. Eight per cent is condensed and 12 per cent is made into butter and ice cream. The latter is becoming popular, especially with the Japanese who have visited America.

Tokyo is the largest city and receives its milk from the dairy farms in tall cans with small necks and closed with a wooden stopper. Most of the work of filling the bottles is done by hand. The pasteurizing is done after the milk is bottled. It is pastuerized at 145 degrees F. and held 30 minutes. It is then cooled, labeled, sealed, and is ready for delivery.

The usual jinrikisha carts are used for delivering the milk. It is hauled by a man or a boy and is supposed to serve from 75 to 100 customers. Where it is not practicable to use these carts the milk is delivered in covered baskets carried on bamboo poles over the shoulders.

There are some very good milk plants and factories in the country and the development is so rapid that any description will be almost out of date before it can be printed.

CHRONOLOGICAL EVENTS

YEAR

Ancient	Cattle—origin unknown.
A. D. 6	Agriculture received much attention, 800 canals and ponds built for irrigation.
71-130	Granaries established to guard against famines.
283	Art of working in silk introduced from Korea (Chosen).
552	Buddhist religion introduced.
1853	Japan opened ports to foreign countries.
1911	First cow-testing association organized.

NUMBER OF COWS, TOTAL CATTLE AND MILK COWS (Japan Yearbook)

Year	Native Cows	Grade Cows	Foreign Bred Cows	Total Cattle	Milk Cows	Average Yield
1899	685,106	70,002	14,055	1,252,865	.....	Pounds
1900	676,600	82,715	15,343	1,261,214	.....	.....
1905	560,295	171,278	15,943	1,167,610	.....	.....
1910	569,441	322,857	18,404	1,384,183	41,333	2,581
1915	605,244	307,969	12,739	1,387,922	43,645	2,861
1920	629,859	310,310	16,838	1,376,049	41,682	3,363
1921	658,789	323,020	19,294	1,437,254	42,986	4,206
1922	.....	.....	.....	1,459,226	53,750	.....
1923	.....	.....	.....	1,474,329	.....	.....

QUANTITY OF DAIRY PRODUCTS MADE IN FACTORIES (Japan Yearbook)

Year	Condensed Milk	Butter	Artificial Butter ¹
	Pounds	Pounds	Pounds
1915	4,863,170	682,282	410,793
1916	8,520,541	897,084	481,869
1917	8,271,925	1,428,258	811,687
1918	14,405,419	1,302,749	750,592
1919	18,852,588	1,203,253	907,704
1920	16,950,635	1,082,600	908,194
1921	17,506,772	1,146,173	1,015,298
1922	15,708,000	1,205,000	.....
1923	.....	.....	.....

¹ Principally vegetable.

CHINA.

NATURAL CONDITIONS—China comprises nearly one-third of the continent of Asia. It is situated between 18° - $20'$ and 56° North and longitude 70° and 143° - $30'$ East. It has about 4,098,823 square miles of land and a population of between 446,-500,000 and 550,000,000. In fact it is in area nearly one-tenth of the whole world.

The surface of the country is diversified with hills, mountains, plains, valleys, and a large portion classified as desert, while Thibet is so high in the mountains that it is called the "roof of the world," and is cold most of the year, with little vegetation or grass. The valleys of China are extensive and cultivated intensively in very small farms of from 3 to 6 acres.

The mines are extensive and comprise, besides metal, salt, coal, and petroleum. The great plains are fertile and the principal products for export are tea, silk, and cotton, but many agricultural products are produced and consumed in the country. Land is so scarce that the steep hillsides are terraced to increase surface, rocks are covered with earth, the lakes have floating gardens, and the bottoms of streams are planted with aquatic plants whose seed or roots are used as food. The production of food is not sufficient, however, and great quantities of supplies, especially of rice, are imported each year.

The people are generally peaceable, industrious and thrifty. Poultry farming is a very important industry, and its products are used for home consumption and export trade. Pigs are found in the southeastern provinces. Sheep are generally neglected and neither beef nor mutton is consumed to any extent.

Concentrated foods, with the exception of fish, eggs, and poultry, enter very little into the dietary of even the wealthier classes. Cereals, including soybeans and vegetables, form the great bulk of the food of the masses.

The cereal cultivation has continually encroached upon the pastoral areas and now nearly all the productive land is under cultivation. Indeed, the less fertile portions of the hillsides and moun-

tains, instead of being covered with grass are covered with timber. This makes it necessary to feed the livestock on the products of the cultivated lands. This accounts in part for the large proportions of small livestock, pigs, and chickens, and a lesser number of cattle, horses and sheep.

The lack of good roads is also a serious drawback, as people sometimes starve not 50 miles from regions of plenty.

EARLY CONDITIONS—Fu Hi, legendary founder of the Empire, 2852-2738 B. C., taught his people hunting, fishing, and the rearing of herds and flocks. The conditions before the time of Fu Hi can be guessed from the one statement handed down that "before that time children knew only their mothers."

The ancient importance of cattle is noted in the edict of Si Hwang Ti, in 212 B. C., when he ordered the destruction of all books except on medicine, divination, husbandry, and records of his own dynasty.

Gibbon says that the conquest of China has twice been achieved by pastoral people of the North. He also refers to "a Chinese princess described in verse who lamented that she had been condemned by her parents to a distant exile and a barbarian husband; who complained that sour milk was her only drink, raw flesh her only food, a tent her only palace." (375 A. D.).

The following quotations from Chinese authorities indicate the extreme views of milk consumption in China.

"Milk, they use little or none. Cows as domestic animals are employed for draft purposes. Babies, invalids, and the aged are sometimes given human milk, but the usual child and adult never tastes milk at all. Mothers nurse their children for long periods and then sometimes secure a wet nurse to prolong the nursing till the child is a year and a half to two years old."

A Chinese edict posted in a public place read:

"You are not allowed to drink cow's milk. Man has no right to take from animals their nourishment, particularly the cow, which is the most useful of all. Those who sell milk pollute their conscience for the sake of money, and those who drink it with the idea that their bodies benefit by it are not less blamable. Under the pretext that their children feed themselves with milk, they wish to do the same, but animals have their needs. Who will feed the calves if men take all the milk from the cows?"

CATTLE—Cattle have been numerous in all ages of China but little is said of them and few descriptions are to be found.

These cattle were smaller and somewhat inferior to the cattle of countries further west. The one exception is Thibet, where the yak, a very tall animal, is the family cow and although it finds little vegetation in its high mountain home yet it retains its vigor and size.

According to consular reports there were only two breeds of cattle in the Yang-tse valley in 1887.

Yang-tse Cattle—The cows are small, compact, weigh about 400 pounds, and produce a calf in the third year, then live about 20 years—color, dark red. Milk and its products were little used by the people, and butter and cheese were not known in that part of the empire. About three quarts a day is the yield of the best cows. The meat would be good if the cattle were properly fed but as they are not killed until they are very old the beef is very inferior. The cows had very small udders but the milk veins were large. The origin of the breed could not be learned but the breed seemed to have been in that section as long as the Chinese themselves.

The cattle of Canton or southern China are generally of the buffalo breeds.

Water Buffalo (Carabao)—The water buffalo has been in southern and southwestern China for centuries being used as a draft and beef animal. Some authorities think that its original home was in northern India. The water buffalo has been carried to many lands including all of India, Straits Settlements, Indo-China, the Philippines, and other Pacific Islands, Italy, Austria, Borneo, Sumatra, and Brazil. In China proper they exist as far north as 200 miles north of Shanghai. They do not live in cold countries. The buffaloes of Africa are of a different species and have not been domesticated.

The average weight of the mature animals in China is from 800 to 1,400 pounds. The height varies from 46 to 50 inches at the withers. The beef-draft animals are smaller than the dairy types of buffaloes, which varies from 56 to 60 inches in height and weighs from 1,500 to 2,000 pounds.

The water buffalo is dark gray or almost black, with markings on face and legs at times. Pure-white albinos are not uncommon

in southwestern China. The skin of the buffalo is like that of the hog, having practically no sweat glands, and therefore can wallow in the mud and water on hot days like a pig, hence the name "water buffalo."

Calves are born with a full coat of brown hair but this is mostly lost at about one year of age and the mature animals have little hair on their bodies.

The horns are characteristic but vary with different breeds. The horns of the beef draft type are large, triangular at base, and have sharp points. The horns extend backwards over the neck. The Delhi breed have horns more like rams' horns.

The gestation period is from 10 to 11 months, the calves weighing from 60 to 80 pounds at birth.

The movements of these animals are slow and unwieldy, similar to that of elephants. These buffaloes are not suited to lands without water in abundance, as they can not stand the heat of mid-day without water on their bodies. How unlike the zebu, which never goes into the shade nor stands in the water.

No dairy breed of buffaloes has been developed in China, as is generally supposed; the Chinese did not consider milk suitable for human food until the Europeans came to China. This is unusual and inexplicable, as the Thibetans on the west and the Mongols on the north have used milk of cows, goats, yaks, or mares from time immemorial.

The first buffalo dairy was begun in China about 1905. The milk of the Chinese buffalo is very rich in fat, and is also palatable. When fresh, buffaloes give from 5 to 15 pounds of milk daily, decreasing gradually during the lactation period, which lasts from 8 to 12 months. At the Canton Christian college, according to C. O. Levine, many tests have been made with buffalo cows and results compared with European cows. These tests indicated a fat content of 11 per cent in the buffalo milk, the animals giving 250 to 300 pounds of fat per lactation period. The milk contains more proteids, sugar, somewhat more ash, and nearly twice as much solids as does European cow's milk. The milk is pure white in color, and butter made from it is also pure white.

DISEASE—Tick fever, which is prevalent in South China, has no effect on the buffalo. Rinderpest is generally fatal but the

anti-rinderpest serum is used with good effect. Tuberculosis does not affect the buffalo.

The possibilities of the buffalo may be seen from the tests made at the Canton Christian college, where a buffalo cow was milked for a year and produced 260 pounds of butterfat from 2,000 pounds of milk. None of the ancestors of the cow had ever been milked.

The buffaloes will thrive on much poorer feed than other cattle. When housed at all they have bamboo sheds, very poor, but as good as those occupied by their owners. They are fed in the winter, when vegetation is destroyed, on wheat straw, rice straw, and sweet-potato vines. The last named is esteemed as the best feed. In the open season they are allowed to forage, browsing on wild grass, bamboo sprouts, and the foliage of reeds that cover the marshes. They are unrestrained by wall or fence and when foraging are kept from cultivated fields by small boys who lead them, or sit on their backs and direct them to the best grazing by guiding cord through a ring in the nose.

No attention is paid to selection and the cows mate by instinct, so "in-and-out" breeding has possibly degenerated the breed. It is known that other than pigs and chickens, the cow, including the buffalo, is the most common animal in China. Total cattle in China, 1914—21,997,000; 1915—22,886,000; 1916—15,973,000. The sale of hides in China amounts to more than \$20,000,000 a year, and a recent trade report says that China has 44,714,368 sheep and 15,973,279 cattle.—(Extract from C. O. Levine et al).

TIBET.

YAK—The yak inhabits the highlands of Tibet and some parts of Siberia and is one of the largest of the bovine species. It has long hair on its sides and flanks, reaching down sometimes to the fetlocks, and its tail is large and bushy. The purebred yaks are black or brown and are large, magnificent creatures. They have rather short legs and yet stand 6 feet high at the shoulders. The purebred yaks thrive best at an elevation of from 13,000 to

16,000 feet above sea level, and in summer can not be brought down to even 11,000 feet.

There is, however, a half breed from mating a yak with the female zebu, and the cross or hybrid is called the "Zo" or "Zobo." These hybrids can live in lower altitudes, even in England, where they are very prolific among themselves. They are white and black, or white and gray, or all white. There is a small black polled breed which flourishes at low levels.

Purebred yaks are vicious and spiteful brutes, are really only half tamed, and are liable, after running loose for several weeks, to cast their loads when brought once more into active service and will even charge on the attendants. The tame yak has been known by repute since the Grecian times. It eats grass only, and as the grass spots in the highlands of the mountains are miles apart, it is difficult to keep them properly fed.

Yaks in Ladak and Tibet are saddled for riding and for pack carrying. They are sure-footed and are said to carry burdens up places which ponies and mules would not attempt. In Leh and other valleys in Ladak the halfbreed zo (females are called zomo), is employed in plowing, but the purebred does not take kindly to that kind of labor. The Rupsu Tatars depend entirely on their flocks and herds for their livelihood (Lydekker).

The Tibetans depend almost entirely on the yak for milk and butter, which are very important articles of diet in that country. Butter lights are used throughout the country and butter tea is consumed from morning to night. It is really a kind of soup made from butter and tea. Butter is used in offerings and the quantity used indicates that the production of butter must be large.

DOMESTIC CATTLE—The dairy cattle of Manchuria are of two kinds: Native breeds and improved breeds (grades). The first group is very small and includes the Mongolian and Siberian purebreds and grades. Among the second group are found the Friesian and Simmenthal cattle. This group is in greatest favor but the herds are not kept pure and the mixed breeds present a motley appearance.

The milk yield of the various breeds in Manchuria are given by a consular report as follows:

MILK YIELD OF MANCHURIAN COWS AND FAT CONTENT OF MILK.

Breed	Milk yield Pounds	Fat content Per cent
Friesian	7,928	4.1
Simmenthal	7,236	4.3
Siberian	4,464	4.4
Improved Russian	5,436	4.3
Improved Mongolian	3,348	4.4
Mongolian	1,620	4.5
Trans-Baikal	2,016	4.4

CONSUMPTION—It is the general impression in the Western Hemisphere that the Chinese live on rice. In southern China that is largely true but even in regions where rice is grown the diet is mixed with soybean products. In northern China wheat bread is largely used instead of rice together with large quantities of soybeans. In fact some authorities claim that the soybean is the most universal article in the Chinese diet, taking all the 300 or more varieties.

The use of soybeans is as old as history in China. It is said to be a well-balanced food, rich in protein, fats, and carbohydrates, as well as vitamins A and B but lacks in minerals.

Adolph gives soybeans a very high place as a human food:

"During the last few years the soybean has found application in the infant dietary, and has become one of the recognized diabetic foods. One of the most satisfactory forms of artificial milk is made from soybeans. Some of the bread used by the French in the recent war was made essentially from soybean flour."

Oil is expressed from the beans and used in cooking in the Far East.

A kind of bean curd or bean cheese is made from these beans. In the manufacture of soybean cheese the beans are ground with water, strained, and the residue is used for hog feed. The liquid substance is like milk in appearance and on coagulation becomes the bean curd, or, as it is sometimes called, Chinese cheese. There is an enormous consumption of bean cheese in China and in Japan. Still it is not made in factories. Every small town has a bean-curd shop. It must be made fresh each day, and resembles cottage cheese. It is pressed into cakes 5 inches in diameter and about an inch thick and sells at about one cent, American money. The cakes may also be salted and dried and they then resemble cream cheese. Tradition

says that it was first made about 164 B. C. When the cheese is prepared with sugar it resembles custard and again when salted it resembles scrambled eggs.

Soybean milk is in composition not so much unlike cow's milk, and in many places in China it is used as a drink, usually sweetened. Soybean sprouts are made ready for use by cooking them in oil and are relished even by westerners. The soybean cake is the residue after the expression of oil or after the making of milk, and is used for animals only. It really has much food value and during the famine in North China in 1920-21 much of this bean cake was used to save the starving people. From a nutritive standpoint it is supposed to be a substitute for meat and milk, as the Chinese consume large quantities of bean products and small quantities of meat and milk. It is a common saying that "Bean milk is the poor man's milk and bean curd is the poor man's meat."

In central China, according to a consular report (1925), in good years the farmers live so low that they must eat elm bark and the buds of trees to live. This is reported to be a common practice in the spring of the year—the buds of the trees and leafy vegetables are now known to contain vitamins and these, with the great quantities of eggs eaten by the people, to some extent make up for the lack of milk and its products.

In Tibet, where cows and yaks abound and milking is one of the duties of the women, there is no fresh milk. Tibetans say that they drink buttermilk because sweet milk impedes the breathing, and that by churning all the milk they are able to get butter enough. They burn butter in their lamps, they color it, and mold it into patterns on cakes that adorn their altars. They eat it and wear it. Soldiers' rations include sheep bladders of butter, travelers carry them on a journey, housewives keep them hanging in the kitchen, for years, if possible, for they prize rancid butter as westerners do ripe cheese. In the winter both men and women smear themselves with butter until they shine and reek with it. They feed themselves with buttered tea—a soup made of boiled tea, strained through a sieve and then churned with butter and thickened with "tsamba." Europeans loathe this concoction and hospitable Tibetans tax the politeness of shivering, unbuttered guests by adding an extra lump of long-aged butter as a special compliment (Marietta Neff).

The following by Dr. Wm. W. Cudbury, in *American Journal of Diseases of Children*, January, 1920, helps to give a better understanding of the manner in which the Chinese make up for the lack of dairy producers:

"At the present time fresh butter, milk, and cheese are rarely used by the Chinese people, and canned milk has been introduced into the more modernized districts only within the last two or three decades. In view of these facts one is sometimes amazed to observe that children can grow strong without milk, and that tuberculosis of the forms generally considered as bovine in origin may be very prevalent among people who eat neither beef, butter, nor milk. Rachitis is seldom seen. Nevertheless I would be the last one to depreciate the great value of dairy products as a food, and it is undoubtedly because of their absence that thousands of China's babies die yearly. When an infant is weaned it is given congee, or rice gruel, and before he is a year old the mother begins to feed him with rice—which is to be the staple of his diet as long as he lives."

MODERN DEVELOPMENT—There are dairies in the largest cities. In Peking the cows are of the Russian and Russian Brown-Swiss varieties and are good milkers. In Hongkong the dairies have more than 1,200 Holstein and Ayrshire cows but these cattle are very much affected with tuberculosis and rinderpest. The dairies of Shanghai do not use the buffalo, as it is out of their range of climate.

Mongolia and Manchuria possess great tracts of the world's finest grazing lands. Great development in dairying and beef production probably will take place in these provinces when the demands are sufficiently strong.

In northern Manchuria, where there are limitless pastures, the price of milk, butter and cheese, in 1924 was higher than in other parts of the country. With the construction of the Chinese Eastern railroad the Russian settlers followed, bringing their dairy cattle for their own use. This was necessary if milk and its products were to be obtained, as the native people used little and sold less of the dairy products. These settlers, generally railroad employees, still own about 40 per cent of all the cattle in the province. Dairying is very primitive although some butter and cheese are made. The old-fashioned dash churn is still in use in every family.

The city of Harbin and its suburbs own one-third of all the milk cattle in Manchuria.

In the western territory the cattle, when fed in stalls, are given dry, coarse feed, such as hay, straw, and some receive about 5

pounds of chaff daily each. In the Harbin district the animals receive 10 pounds of bean cake daily in addition to the roughage. In the summer the cattle are herded near the city and at evening the herder blows a horn and the owners come out and drive their cows home.

There are a number of small cheese factories in and around Harbin which manufacture possibly 144,000 pounds a year. Harbin alone consumes 360,000 pounds of butter a year.

AFGHANISTAN.

Afghanistan has one district doing some dairying: it makes and sells ghee but consumes a substitute. This is the country of fat-tailed sheep. The fat in the tail is one of the most valuable portions of the animal and is used largely as a grease substitute for ghee, or clarified butter. It is because of the widespread use of sheep grease that it is enabled to save most of the ghee produced for export to India.

This country has fine grass lands and the climate ranges from tropical to an almost continuous winter weather in the highest portions of the mountain sections.

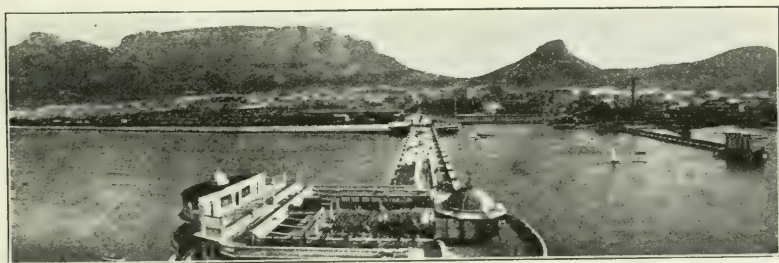
OUTLOOK—China has few cattle compared with the population, possibly one animal to 30 persons. If only half of the cattle are cows that would make one cow to 60 persons. However, the cows are not generally milked and of those milked the yield is small; therefore, it seems probable that China gets little milk from its herds.

Imports of dairy products are increasing rapidly and as the Chinese learn of the value of dairy products there is a possibility of a market second to none in the world. It is estimated that the normal consumption of butter is small, possibly not more than 2 million pounds a year; most of this butter comes from Siberia, Australia and New Zealand. The consumption of imported condensed milk amounts to about 5 million pounds a year.

FOURTH CHAPTER

UNION OF SOUTH AFRICA AND OTHER AFRICAN COUNTRIES.

NATURAL CONDITIONS—The Union of South Africa, comprising Natal, Orange Free State, Transvaal, and Cape Colony, has an area of 470,000 square miles (300,800,000 acres) and of this vast tract of land there is a rainfall of less than 15 inches a year over 185,000 square miles and less than 25 inches over 355,-



The Gate of South Africa: Table Bay.

(Photograph by Publicity Department, South African Railways.)

000 square miles. The rainfall is variable and uncertain and is, therefore, the principal drawback to dairying in that country. In view of the uncertainty of the rainfall there has been an unusual effort exerted to develop irrigation for cropping and feed purposes.

The soils in South Africa are varied but there is an abundance of good loam soil.

GRASSES AND FODDERS—Kafir is indigenous to this region and was being cultivated by the Bantu tribe long before European occupation. At present it is a valuable crop for feeding purposes. In 1923 the total production was 2,057,000 200-pound bags. Maize (corn) was unknown prior to the settlement of the English.

Lucerne is the most important forage crop in South Africa. It was introduced about the middle of the 19th century and was grown on a relatively small scale at first, but the rage of ostrich

farming in the 70's and 80's gave a tremendous impetus to lucerne growing, as it was found to be essential to the growing of ostriches, it is asserted, and to the production of fine feathers. When the price of ostrich feathers fell so low that the farms were no longer profitable, these alfalfa fields were turned to the pasturing of dairy cows and thus the ostrich helped to put South Africa into dairying. It is well adapted to the irrigated land and the yield is heavy. The adaptability of alfalfa to dairy cattle feeding is now well known in that country. The potential lucerne production is governed mainly by the extent to which irrigation facilities can be provided.

The forage crops produced in the Union during 1921 were: Lucerne, 142,000 acres; Teff, 260,000; manna, 67,000; other grasses, 33,000.

EARLY HISTORY—South Africa was discovered by Bartholomew Diaz in 1486, in an attempt to reach India by an ocean route. The country was inhabited by black tribes. The Hottentots had many cattle when first seen, in 1614. When Van Riebeck (Dutch) landed at the Cape in 1652, he found a land with long droughts and natives with cattle and sheep. The first Dutch settlement consisted of nine sailors and soldiers and was made in 1657 as free burghers on the land allotted them—the forerunners of the “boer” population of South Africa. These burghers bought cattle from the natives and began cattle raising for beef. Four hundred slaves were landed in 1658 and were not emancipated until 1833.

The Cape was captured by the English in 1795, when the only occupation was agriculture and cattle raising. The first English settlement was made in 1820.

CATTLE—The cattle which were found in the possession of the Hottentots, Bushmen, Bantu, and Kafirs, along the coast where the vegetation was more luxuriant were, in general, superior to the cattle of the dry districts of the north and west, which latter were described as “gaunt, bony creatures with immense horns and long legs.” The coast cattle were better for dairy purposes and as there was a great need for draft cattle it was a deciding factor in their favor, and from these cattle the principal breeds of native cattle were produced. The “Afrikander” was the greatest service animal so developed. It was produced by a system of selection and possibly the admixture of some blood of English or Dutch cattle. The Afrikander is red and resembles the Devon.

In 1658 the colonists had only 278 head of cattle. (The figures for South Africa are generally for the cattle of the white farmers, as the native stock was for years known only approximately.)

The cattle of this country may be divided into three classes: Native breeds, found in the country and bought by the colonists; the Afrikaner, a distinct type of cattle created by selection and breeding, but slow of growth and a poor dairy animal; imported pure breeds of dairy and beef cattle and crosses of purebred cattle and the native stock.

The outstanding characteristics of the native was their hardy constitution and their ability to withstand the natural conditions of the country. The existence of such cattle in the country was of great significance to the colonists and rendered possible the producing of a breed of cattle (the Afrikaner) adapted not only to the natural conditions but also to the peculiar economic conditions of South Africa during the more than 200 years of its occupation by Europeans. The bodily shape of the Afrikaner is different from European breeds. The Afrikaner has strong but drooping hind quarters and a large development at the top of the neck for holding the yoke. The body is very compact. These cattle are bred for three purposes, draft, slaughter, and dairying. It is the best suited to the first. The breed was continued largely up to about the year 1870, when other changes caused it to decrease rapidly. The breed was first produced in Cape Colony in the course of the 18th century and afterwards, at the time of the great trek, it was diffused over the territory now comprising the Union. It was the Afrikaner that made the great trek possible, as these cattle hauled the families of the discontented colonists from Cape Colony to the Orange Free State, Natal, and Transvaal.

Most of the cattle of the Union still show the predominance of the Afrikaner and other native blood, but as the railroads have dispensed with the services of thousands of these draft cattle the purebred cattle have largely taken their places in the farm economy of producing beef and dairy products for domestic consumption and for market.

DAIRY CATTLE—The foundation stock of the improved breeds of dairy cattle formed at the Cape in the 18th century was composed of Friesian cattle which had been imported from The

Netherlands to improve the milking qualities of the Afrikander and native breeds. It was in the 19th century that the British breeds were imported. These breeds consisted of Ayrshire, Jersey, and Kerry cattle, and were used to cross with the native breeds. In this way the so-called "Cape cow" came to be a composite breed of the Afrikander, the Ayrshire, the Jersey and the Kerry. The Afrikander characteristics have been practically eliminated but not so with the other breeds, one of which generally predominates "depending on the last sire."

Thus the cattle of South Africa have been greatly improved and have also been scattered over all the country. These crosses of the native stock have retained much of their hardiness and were, therefore, suited to the climate and droughtiness of the country and at the same time their milk yield was greatly increased. In the eastern part of the Cape the Shorthorn breed was a favorite with the English farmers and where the conditions were good and there was an abundance of grass the breed thrived.

Although the bulk of the cattle of the Union are what might be called "utility dairy cattle" grades in which Friesland and Shorthorn predominate, there are also many herds of purebred Friesian, Ayrshire, Jersey, Milking Shorthorn, South Devon and Red Polled. During the last 30 years great headway has been made in the quality and quantity of milk produced from the purebred cattle.

In 1919 there were 7 livestock societies in the Orange Free State and 9 in Natal. Of dairy societies there was not one in the Orange Free State.

DEVELOPMENT—In the earliest period of settlement there were no dairy products except for the use of the settlers and such ships as put in at the Cape Hospital. As the colonists moved back from the coast there was an ever-greater question of transportation and this, coupled with the poor quality of the butter, did not tend to encourage the establishment of a trade in dairy products. Later, when the railroads gave a service to certain sections of the country, it became possible to send produce to market and as cattle were not so much needed for transportation purposes attention could be turned to dairying and beef.

FARM BUTTER—In the pioneer stage of dairying farm butter was a necessity, as the creamery system was in its infancy and little used, but now (1925) it is quite different. Large quantities of farm butter are still produced but the quality is so variable that there is much loss in price. However, farm butter still amounts to several million pounds a year.

CREAMERIES—Honorable Joseph Bayne, C. M. G. (better known as the father of the dairy industry), established the first creamery in South Africa. The adoption of the factory system has met with success, as there were in 1921 78 creameries and 140 cheese factories, mostly operated on the cooperative basis, and in addition there were about 250 privately owned cheese factories. The success of these cheese factories may be appreciated when it is known that for 2 years in succession the cheese from these factories carried off all the principal prizes of the London Dairy Show.

The output of the creameries has been increasing. In 1911 the production was slightly over 11 million pounds while in 1918 it was well over 20 million pounds.

The cheese production for the year 1918 was 6,023,000 pounds, but the year 1919 was a disappointment, as there was a plague of caterpillars and the aftermath of the influenza was followed by the drought in all parts of the Union during the months of November and December. The principal cheese made in the Transvaal is Gouda.

There have at times been importations of margarine and ghee but the ghee imports have decreased, as a few of the creameries have taken up the manufacture of ghee for domestic use.

COOPERATION—The cooperative sentiment is strong as the farmers seem to have a desire to organize into unions. Cooperation in the keeping of cow-testing records continues to make rapid progress but its benefits are not fully realized by those engaged therein. Although the present system applies with one or two exceptions, to Friesian breeders only, it has rendered quite a service to the industry.

The progress of the industry in the Transvaal is perhaps not quite so rapid as that of the other provinces; and there is room for considerable development in winter dairying in northern Transvaal.

TRADE — The exportation of butter from South Africa has been to England and the amounts have ranged from one to three million pounds a year. The importations, which were rather large for a few years, have decreased until it is proper to say that South Africa supplies herself in dairy products. The following taken from a report of Vice Consul Charles J. Piser, Cape Town, gives the production by provinces and indicates the condition of the same at the close of the World War:

Figures recently made public by the Director of the Census show the total production of butter in the Union of South Africa in 1918 to have been 21,973,965 pounds, and of cheese 8,822,685 pounds. This output was distributed among the four provinces of the Union as follows:

Province	Butter		Total	Cheese		Total
	Farm	Factory		Farm	Factory	
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
Cape.....	4,698,400	3,934,686	8,653,086	1,270,800	3,627,491	4,898,291
Orange Free State.....	1,371,900	4,722,662	6,144,562	185,600	1,837,730	2,023,330
Natal.....	857,300	3,237,389	4,094,689	120,400	676,163	796,563
Transvaal.....	1,151,500	1,930,129	3,081,629	177,700	626,801	804,501
Total.....	8,079,100	13,894,866	21,973,966	1,754,500	6,768,185	8,522,685

DAIRY SCHOOLS

Location	Kind of School
Cape of Good Hope . . .	Elsenburg Agricultural College.
Natal	Cedare Agricultural School.
Transvaal	Agricultural instruction on Experimental Farm.
Transvaal	Potchefstroom Dairy School.
Transvaal	Potchefstroom School of Agriculture.

CHRONOLOGICAL EVENTS

YEAR

1486	South Africa discovered by Bartholomew Diaz.
1614	Hottentots were noted as having large herds of cattle. Their food was meat, milk, roots, and wild fruit.
1657	First settlement by Dutch burghers, "Boers."
1658	278 head of cattle in the colony.
1658	Four hundred slaves brought in; emancipated in 1834.
1695	English took possession of Cape Good Hope.
1820	First English settlement.
1836-38	First "trek" of Boers—about 10,000.
1850-60	Lucerne (alfalfa) introduced.
1848-50	Great trek, from Cape to northern territory.
1885	Discovery of gold.
1899	Boer War—South Africa then went under one government.
1910	Formation of Union of South Africa.
1914	World War.
1919-20	Drought.

NUMBER OF COWS AND TOTAL CATTLE
(Year Book of the Union of South Africa)

Year	Cows	Total Cattle
1911	1,900,230	5,796,949
1918	1,924,925	5,171,654
1921	2,263,778	6,201,411

Milk production—no returns available.

TOTAL PRODUCTION OF BUTTER AND CHEESE
(Year Book of the Union of South Africa)

Year	Butter	Cheese	Year (1)	Butter	Cheese
	1,000 Pounds	1,000 Pounds		1,000 Pounds	1,000 Pounds
1910-11	11,349	545	1916-17	17,110	4,266
1911-12	10,568	775	1917-18	20,093	6,023
1912-13	10,742	1,025	1918-19	21,693	5,519
1913-14	10,722	1,239	1919-20	17,809	4,054
1914-15	13,407	1,893	1920-21	18,963	4,619
1915-16	12,982	1,975	1921-22	21,873	5,340

IMPORTS AND EXPORTS OF DAIRY PRODUCTS
(Year Book Union of South Africa)

Year	Condensed Milk Imports	Butter		Cheese	
		Imports	Exports	Imports	Exports
	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds	1,000 Pounds
1909	19,059	4,466	8	4,256	0
1910	20,614	3,606	14	4,651	0
1911	22,408	4,121	20	4,949	0
1912	20,948	4,925	43	5,166	0
1913	22,668	3,893	45	5,586	0
1914	20,955	3,919	78	5,223	0
1915	19,263	2,026	97	3,966	2
1916	13,711	268	1,558	2,029	25
1917	12,805	27	2,978	513	77
1918	3,854	2,425	1,317	234	425
1919	8,644	356	427	20	1,526
1920	12,376	622	410	1,200	296
1921	7,282	382	2,635	49	448
1922	6,930	196	1,472	268	142
1923	10,717	1,166	551	832	108

NORTH RHODESIA AND SOUTH RHODESIA.

Rhodesia lies to the north of the Union of South Africa and is a large country of itself. It is a part of British South Africa and is given over to the beef industry rather than to dairying although there are some fine dairy herds in Rhodesia.

There are many ranches in North Rhodesia and South Rhodesia. These large ranches are well up in the highlands, some 1,600 feet, and although this country reached far toward the equator the climate is still temperate but there is seldom a frost in Rhodesia. Some of these great ranches cover from one to three million acres.

Dairying is extending into these regions but there are many disadvantages in any kind of cattle raising and this applies equally to dairying. There are cattle ticks, tsetse flies in some parts, and wild animals that kill the cattle; hence the progress of dairying is slow. As to the extent of dairying the cream sales in 1922 was 624,261 pounds and for that year there were also exported 277,700 pounds of butter. The imports of butter for the same year were 172,225 pounds.

The cheese production was quite small and amounted to only 39,333 pounds for that year.

OTHER AFRICAN COUNTRIES.

ALGIERS—The Algerian cattle have made no progress in either quality or numbers within recent years. There is a considerable export of oxen and cows while some dairy products are imported. The number of cows in 1923 was 440,406. In 1922 the butter imports amounted to 1,966,503 pounds and the cheese imports to 7,197,014 pounds. Though there are many goats and cattle in the country still very little dairying, other than for family supply, is carried on. The following table shows the number of cattle and goats in Algiers:

Year	Cattle	Goats
1887	1,210,000	.
1901	1,035,000	3,923,000
1911	1,114,000	3,862,000

EGYPT—Egypt has the climate, the soil, and the pastures for dairying and as far back as history reaches there were cattle, cows, and dairying; those ancient peoples realized the importance of their cattle as is indicated by the care, reverence, and attempts at immortalizing them by pictures in their sepulchers, in their temples, and elsewhere. Little remains of the ancient dairying in Egypt except the pictures of cows being milked.

The cattle of ancient Egypt have been changed and in modern Egypt there are found the Shorthorn breed, pure and crossed, and the water buffalo, called "gammouse." These water buffaloes give milk testing for fat from 5 to 10 per cent and it is used for making butter. Few farmers make butter and, therefore, fresh butter is scarce.

Imports of dairy products are from Australia and Europe. A melted butter, called "samma," is used in cooking. Butter is also made from goats' milk; however, the most of this butter used is imported from Syria, as practically all Syrian butter is made of goats' milk.

Number of Egyptian Cattle and Buffaloes.

Year	Cattle	Buffaloes
1906	732,537	775,149
1921	596,000	646,000

The pasture lands are not extensive and little attention is paid to dairying. (See General Outlines of Dairying).

ETHIOPIA—The Ethiopian pasture land exceeds the cultivated lands in area. There are vast stretches of desert where the grass is hard and scant, but the grass lands on the lower slopes are much better; however, the most fertile meadows are on the high table land or mountain sides. Here the hay is usually harvested while the plains and lower table lands are usually burned when the grass becomes dry and the grass soon springs up and makes new pasture. Artificial meadows are unknown to the natives, although very much needed.

The cattle are strong and are mostly of the zebu type, but of two kinds. They are used almost entirely for slaughter. Large numbers of goats and some sheep are raised in Ethiopia but they are not used for dairy purposes.

ABYSSINIA—It is estimated that there are at least 10 million head of cattle in Abyssinia. The people of that country have always been great lovers of cattle. Their cattle are mostly of the Zebu type or crosses of the Zebu and the common cow. The plague is said to kill 50 per cent of the calves born each year.

Dairying except for home purposes does not exist.

EAST AFRICA—British East Africa possesses most of the essentials to render it an ideal stock country. The climate of the highlands is so equable that the housing of cattle is unnecessary at any time of the year, although during the rains, cows kept for milk production thrive and yield better results when given some protection at night. The excellence of the pasture lands is said to be equal to that of any other country. Even during the dry season cattle thrive and keep fat on the natural grasses without other feeds. Both pink and white clover are indigenous and grow profusely in many districts, while sainfoin is met with on the Athi Plains and elsewhere.

The native stock is excellent and numerous and from the coast up to Victoria Nyanza are to be found vast herds of animals suitable for grading. At first sight the native cow is disappointing on account of her form, humping shoulders, and drooping quarters, as she belongs to the Zebu type, but she is hardy and thrifty and when crossed with purebred cattle loses all the characteristics of the Zebu except the thriftiness and hardiness. The milk yield of these crosses is said to increase from three to six times that of the dam. The milk is rich, approximately 8 per cent butterfat, and the lactation period extends almost to calving time. The Shorthorn breed is used for grading the native cattle.

There is an up-to-date creamery at Lumbwa which affords an outlet for the milk of that region.

Some of the drawbacks of the section are the lack of transportation, heavy losses due to diseases, such as rinderpest, pleuropneumonia, and East Coast fever (ticks). Much scientific work has been done recently and there is now less disease among the cattle.

MADAGASCAR — The cattle of Madagascar are the native breeds crossed with the Zebu and called "malgache." The island has more than 8 million head of cattle¹. The herds are of peculiar

¹ Authorities differ on the number of cattle. The smaller number is used in this place.

formation, as they consist of an average of 2 bulls, 28 cows, 20 steers, and 40 young stock, for a 90-head herd.

It is said that glandular tuberculosis is not known north of parallel 22 S. but south of that parallel it is very common. The cattle of the north and west parts of the island are larger than those of the remainder of the island. While the number of cattle is very large for the island there appears to be no thought of dairying, although much of the country has the climate, soil, and pasturage to aid it.

MOROCCO—The number of cattle in Morocco is estimated at 1,200,000, of which 250,000 are milk cows. These cattle are very small and seem to belong to two distinct types. One type has a fawn-colored coat and the other a straw-colored coat. The first type has curved horns and the second has lyre-shaped horns. In some districts there is a piebald type of cattle, but in general the breeds seem to be the result of indiscriminate breeding.

The origin of these Morocco cattle is not known but it is possible that they are indigenous in so far as any cattle are indigenous.

Formerly they were used for pack or saddle animals, but now they are used mostly for slaughter, as the cows are not good milkers. The Zebu has been introduced to improve the breeds for draft and slaughter, but nothing seems to have been done toward bettering the milk production. The town herds are better tended than the country herds and the yield of milk of the town cows averages 3,086 pounds, while the country cows yield 1,896 pounds. This yield is figured on the entire lactation period, which is usually about nine months.

GOATS—There are three breeds of goats in Morocco, numbering more than 12 million head, as follows: Maltese, Spanish, and Angora. They produce very little milk and there is no goat milk industry in Morocco; aside from a little whole milk supplied the towns, all other dairy products are for the personal use of the family.

Drought is the principal drawback in Morocco with regard to cattle raising.

WEST AFRICA (FRENCH)—The cattle are suited only for beef and it has been said that they were not suited for beef. It is true that there are many cattle in West Africa, as the following statistics show:

Locality	Number
Senegal	800,000
Soudan (French)	1,800,000
Guinea	400,000
Mauritania	500,000
Total.	<hr/> 3,500,000

Although the ravages of pleuropneumonia in some of these regions have taken more than 50 per cent of the cattle since 1912, it is believed that there are more than 5 million head in West Africa.

There are two types of cattle in West Africa especially to be noted; they are the Zebu, of Hindu origin, and the Taurine breed (humpless), possibly of Asiatic origin.

FIFTH CHAPTER

SOUTH AMERICA, MEXICO, CENTRAL AMERICA AND WEST INDIES

SOUTH AMERICA

In considering South America it is well to note the beginning of cattle on the continent and then taking the countries individually, record the development of the cattle and the countries in dairying. Usually the first step toward dairying in all new countries is the production of cattle, and while the cattle are used mostly for meat and for hides at first, they were also used for milk, wherever found, centuries before the discovery of America, and in this South America is no exception; in fact, it is following the usual trend toward effective dairying and is now just beginning to make her first efforts in that direction and laying the first plans.

The first cattle brought to South America, according to available history, which is not so definite as may be desired, came to the continent from three principal directions: the north in Venezuela and Colombia, the west into Peru and into Paraguay. From these points the cattle spread over the vast regions of the Argentine, Brazil, and the western part of the country, while in the north there were immense herds. Floods and droughts at times carried off millions of head of cattle but their places were soon filled, as in general the climate suited livestock production. In the semiwild state or the wild state the cattle thrived but their characteristics and size were developed to suit the wild conditions. They became smaller, hardier, and their milk production decreased until the cows produced only what the calves needed. The native breed, generally called "Criollo," was produced and had to be removed by amalgamation with the purebred cattle imported, or purebred herds were developed to take the places of the native breed. Both of these methods are being used to improve the cattle. Purebred bulls have been brought into the countries by the thousands and crossed with the Criollo, until in 1925 there are fewer native cattle than there are grades.

Throughout the whole continent there are now the conditions that prevailed in Europe up to the middle of the 19th century, that is, each farmer keeps a few cows and produces his own dairy products and milk: about each city or town there are a few farmers who sell milk and dairy products of home make to the people of the cities. Few markets exist and some of the methods of handling dairy products are the rudest and simplest possible.



La Martona Cattle Barn, Argentina.

ARGENTINA

"To will is to be able"

NATURAL CONDITIONS—The surface of Argentina, which tips gently from the Andes Mountains toward the Atlantic Ocean, is naturally divided into three parts. The part nearest the Andes is mostly desert, salt marshes, and has had little utilization. The second part is the Pampas, embracing the central and eastern sections including the plains. This is a very rich section and is a rolling plain extending from the Andean section to the coast. The third, or "Macedonian" region, lies between the Parana and the Uruguay rivers and has a very rich soil, fine meadows of native grasses, and excellent tree lands in the north.

Argentina is principally an agricultural and stock-raising country and ranks among the leading countries of the world in the production of grain, cattle, and sheep.

The railroads of the country had a total of only 23,205 miles in 1922; hence the transportation facilities are far short of the country's needs and seriously handicap all lines of business. There are few good roads for wagons or automobiles. Due to the very large farms and ranches there is practically no system of public highways, but since the coming of the automobile an effort has been made to build good roads throughout the Argentine.

AREA—The total area of Argentina is 1,153,119 square miles (737,996,160 acres). Only 9 per cent of the land is under cultivation but 253,195,000 acres are used for agriculture and stock raising. In some parts of the country there are large areas of grass lands which have not been stocked with cattle. The natural pastures could support several million cattle, but if transformed into artificial pastures by the cultivation of alfalfa and other forage they could maintain a much larger number of live-stock.

Irrigation has received much encouragement to help offset the effects of the droughts and for the purpose of utilizing the land to the maximum. In 1922 more than 12,000,000 acres were under irrigation.

POPULATION — The original people of this section of South America were Indians belonging to three tribes. These Indians have remained to the present day, although some of the Spaniards have married Indian women and a large population has resulted of this mixed breed called "gauchos." They live on a very low standard, in rude huts covered with hay or brush and subsist almost entirely on a meat diet. These gauchos form a large part of the laboring class but are not suited to so exacting work as dairying. Of the white race there are many nationalities, mostly from Europe. The total population in 1922 was 9 million, or 8.3 persons per square mile, while the urban population was 40 per cent of the total.

CLIMATE—The climate of Argentina varies, becoming colder from the north to the south but the average temperature at Buenos Aires, the center of the dairy district, is about 64° F. (winter 52° F. and summer 72° F.) Frosts are seldom seen as far north as Buenos Aires but on rare occasions snow falls in the city¹. Dr. Latzine says of the climate:

"A climate equally conducive to the health of men and to the productiveness of the soil. Here, men of all the European races, without previous acclimitization, can lead the life to which they are accustomed without the slightest risk to health."

RAINFALL — The eastern portion of the country has frequent rains in the winter but irregular rains in summer, while the portion near the Andes is mostly desert. The Andes Mountains cut off the southwestern rains which therefore fall in Chile. The rains from the north generally are precipitated before they reach the Argentine. Drought sometimes occasion much damage while snowstorms that extend occasionally further north than usual cause great loss of cattle.¹ The rainfall in the Plata region is generally from 20 to 40 inches annually.

GRASSES—For hundreds of miles west and south of Buenos Aires the land is level and not a stone is found. This great plain, "The Pampas," was originally covered with grasses, hard and soft. This grass land has gradually been brought under cultivation and alfalfa has replaced the native grasses and now has

¹ In 1918 Buenos Aires had its first snow storm in years and many cattle perished.

a large place in the furnishing of feed for the great herds of Argentina. The rapidity of the increase in acreage of alfalfa is shown in the following table:

Total Acreage of Alfalfa in Argentina.

(Argentine Yearbook.)

Year	Acres
1896	1,978,000
1900	3,739,000
1905	8,368,000
1910	14,638,000
1913	16,524,000
1922	20,000,000

The wide stretches of alfalfa remain green and furnish excellent pasture the year round. Livestock also graze on the native grasses the full year and there are still several million acres of these



Alfalfa Field, Rafuela, Argentina.

Courtesy of S. Sorensen, Danish Legation

native grasses. During a very hard winter alfalfa or grain is fed for a short time but most of the time the cattle must rustle and suffer. Fat cattle are taken from the pastures direct to market.

The native grasses of the Pampas, commonly called coarse grass, have been replaced around Buenos Aires ever since the first centuries by so-called soft grasses, the seeds of which were brought over by the Spaniards in the forage intended for their horses. These soft grasses were much superior to the Pampas grass and



"Cicque Friburg Breed, Buenos Aires, Argentina.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

before the spread of alfalfa the land was spoken of as "coarse-grass land" or "soft-grass land." The coarse grasses included puna grass, knife grass, rushes, and many unpalatable weeds. The soft grasses included clover, barley grass, altamisa, and some others. Now alfalfa, rye grass, barley, and oats are grown everywhere and other grasses have been introduced.

CATTLE — Cattle were brought to Argentina first from Paraguay and later a small number were brought overland from Peru. (Dates not found). The natives had neither cattle nor horses when the country was discovered and colonized by the Spaniards. (The llama was their principal beast of burden.) These early cattle were turned loose or strayed away and soon scattered over the plains, becoming wild and very numerous. This was about the year 1600. The original cattle were of fairly good

grade but the animals soon deteriorated into the wild state. When the beef industry began to be profitable, in the 70's, the ranchers began to improve their herds by the importation of purebred bulls, principally from England. The first Shorthorn bull "Tarquin" was imported by John Miller in 1848. In fact, that is generally considered the beginning of the beef industry. Imports of purebreds were continued and soon thousands of cattle were imported each year.

The cattle of Argentina in 1908 were composed of native (criollo) cattle 40 per cent, grades 52 per cent, for crossing 3 per cent, and pedigreed 0.5 per cent. The principal breeds were Shorthorn, Hereford, Polled Angus, Jersey, Flemish, Swiss, and Friesian (Hollandaise). The livestock breeders have been very active for several years in getting high-quality, purebred cattle.



"Ipena" Friburg Breed, Buenos Aires, Argentina.

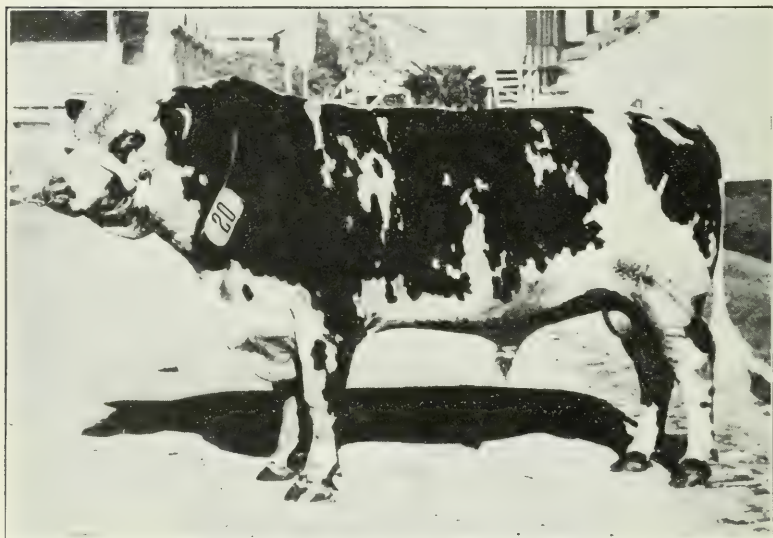
Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

Many of the champions of England's livestock expositions have been purchased for the Argentine, but they have been practically all of the beef breeds.

DAIRY BREEDS—The breeders of Argentina have their own herdbooks, which are under the control of the Royal Society.

founded in 1866 for the improvement of livestock. This herd-book is divided as follows:

- Holando-Frisio, cattle of Holland origin.
- Holstein-Frisio, cattle of American origin.
- British-Frisio, cattle of British origin.
- Jenerland, cattle of German origin.



"Corneille" Imported Norman, Buenos Aires, Argentina.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

Even the dairy herds in Argentina are very large. One breeder has 18,000 head of Holsteins which were bred and raised since he began, about 30 years ago. The quality of the cattle has much to do with the dairying of any country and the following table gives the status of the breeds of cattle, including both beef and dairy, for the year 1914:

Number of Cattle, by Classes, in Argentina.

Kinds	Dairy cows	Cows for breeding	Bulls	Young stock	Steers and oxen	Total cattle
Purebred	29,287	218,833	61,846	97,367		407,333
Mixed	1,263,738	7,785,591	307,669	6,734,650	233,044	16,324,692
Criollos	953,090	3,830,096	308,661	3,536,736	506,155	9,134,738
Total	2,246,115	11,834,520	678,176	10,368,753	739,199	25,866,763

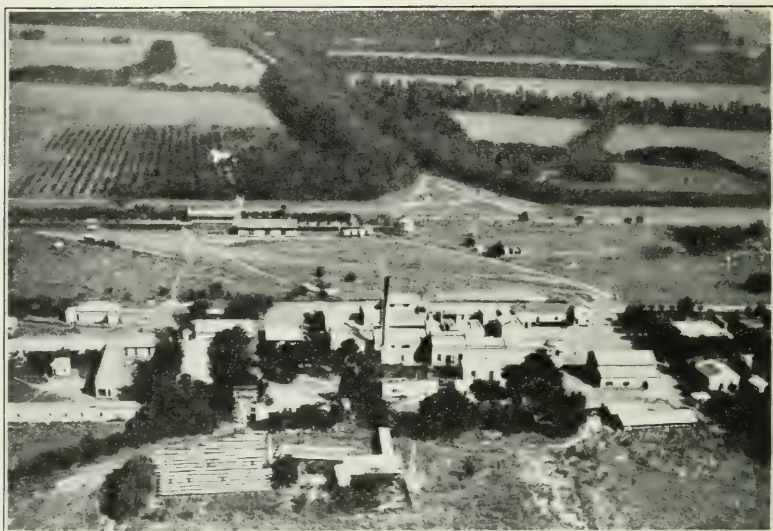
The grading up of the millions of native cattle by the use of imported purebred bulls has been a great undertaking but is succeeding. Such a development, under similar conditions, required centuries in Europe. The development of the dairy breeds has been very well handled and the Argentine Holstein and Jersey breeds have some excellent specimens with very high records of milk production.

DISEASE — Argentina is generally fairly free from cattle diseases but in the year 1901 it was found that the cattle were badly affected by tuberculosis and in 1906-8 a survey was made which proved that in the Provinces of Buenos Aires 18 per cent were diseased. Vigorous regulations were established to prevent the sale of milk containing the germs in that province and also to fight the disease.

DEVELOPMENT—For 350 years after cattle were brought to South America dairying as an industry lay dormant. The native, or criollo, cows have existed ever since the first Spaniards came. The cows were not good milkers but some of them appear to have been both high producers and also producers of milk rich in butterfat content. The dairy industry began with these native cattle and the task has been to grade them into the dairy type, or import purebred cattle for the dairy industry. In dairying, as in beef, both of these lines have been followed with the result that there are many fine herds of dairy cattle.

Until the introduction of alfalfa the progress of dairying was slow but when alfalfa took the place of the hard grasses of the Pampas there was an opportunity and an incentive for dairying, especially as the expense of barns and the storing of feed for winter months was not necessary in maintaining the dairy herd. As the beef production became less and less profitable dairying received more and more attention.

The dairy industry soon reached a prosperous state but then stood still for a time. This was about the years 1902-5. The number of dairy cows continued to increase and this indicates in general the progress of the industry. In 1895 there were 1,800,000 dairy cows in Argentina and in 1908 there were about 2,000,000, in 1914 there were 2,200,000 and in 1922, 3,295,000.



Bird's-eye View of La Martona and Vicinity.



La Martona Dairy, Near Buenos Aires, Argentina.

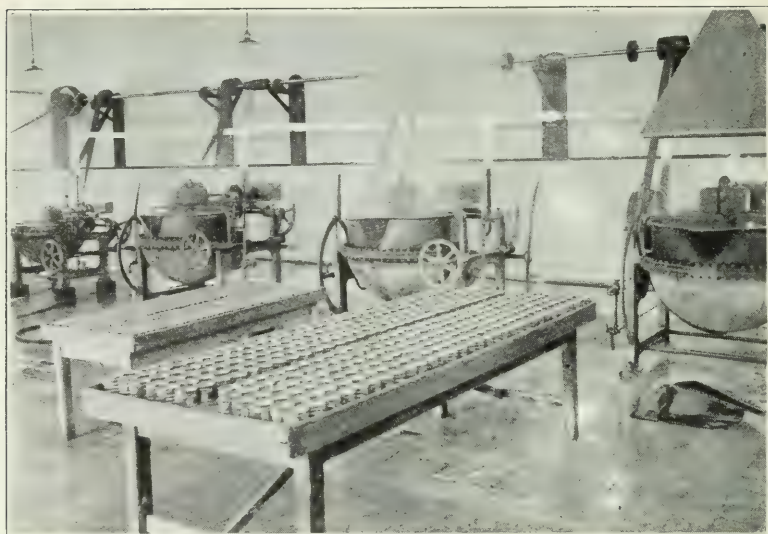
During all these years the dairy cows were kept on pasture the year round and did not receive concentrates. In the spring, on account of the new pasture and the beginning of the lactation period, the milk was not so rich as at other times; however, the yield increased up to January. The cows are reported to have produced from 3 to 25 liters per day (3.3 to 27.5 quarts). The lactation period was short, stated to be from 3 to 4 months.

FACTORIES—The first forward movement in dairying as an industry in this country occurred after the factory system had been successful in other countries and well developed; therefore, the change to the factory system was rapid. The number of dairy factories in Argentina in 1903 was 324, including dairies, creameries, cheese factories, plants making both butter and cheese. In 1913 there were 1,289 factories, mostly owned by stock companies. Really intensive dairying does not exist and can not exist among the large ranches and open ranges, as the people are scattered too much for intensive dairying. There is a great lack of suitable labor, as the "gauchos" do not make good dairymen. The population is sparse in the rural sections and with the poor roads the development of dairying is difficult. The industry is mostly concentrated in the provinces of Buenos Aires, Santa Fe, Cordoba, and Entre Rios.

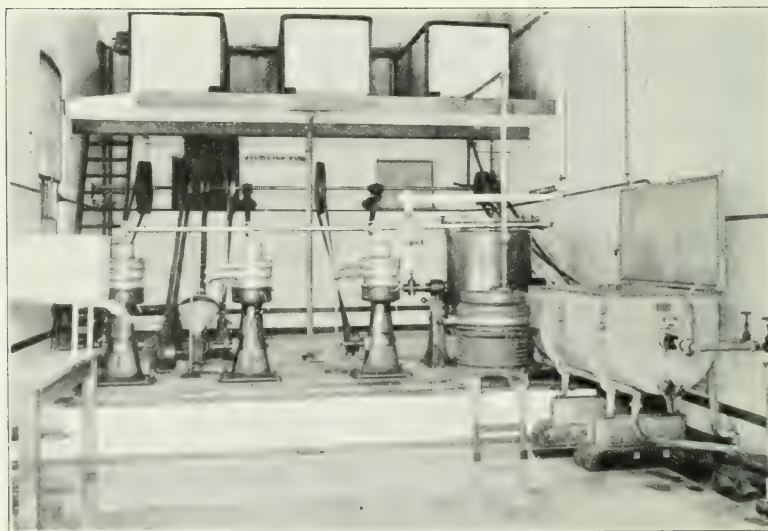
The cheese industry has developed gradually from a production of 2,000,000 pounds in 1903 to about 53,000,000 pounds in 1920. The production of butter in 1903 was 19,477,000 pounds and in 1924 it had increased to 86,117,000 pounds. During the period the consumption of factory butter remained at about $1\frac{1}{2}$ pounds, per person annually, while the consumption of cheese increased from 1.01 pounds in 1903 to 3.67 pounds in 1920.

The number of factories had increased during the war and in 1924 there were in the country as follows: Creameries 1,569, cheese factories 628, butter factories 49, mixed (butter and cheese, etc.) 796, making a total of 3,042 factories.

TRADE—Since the year 1894 there has been some exportation of dairy products to the adjoining countries and to foreign countries. The exports of butter have increased rapidly. In 1910 there was an export of more than 6 million pounds which increased but slightly up to the World War, when the exports rose



La Martona Factory, Cheese Vats.

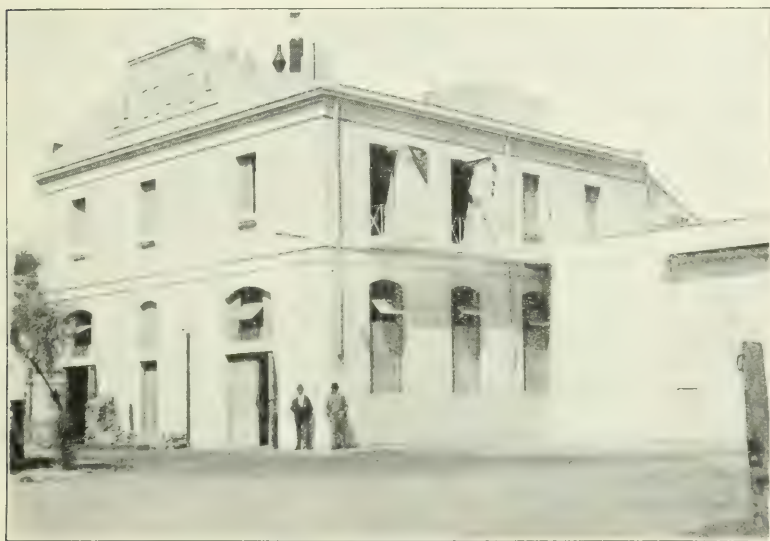


La Martona Factory, Separator Room.

rapidly. In 1919 the exports of butter reached 44,863,000 pounds. This excellent increase in export of butter has been held ever since the war.

Argentina was a large importer of cheese before the World War, but during the war the high prices paid caused the exportation of cheese to increase rapidly and did not fall until after the war and reconstruction. The cheese exports have now (1925) dropped to a low figure again, as the European varieties are being made in Europe in sufficient quantities to supply the most of the world trade.

In 1911 the importance of the dairy industry was such that a special Office of the Dairy Industry and Refrigeration was established by the government to develop the industry more fully.



Granja Blanca Factory.

The milk and cream produced on the large ranches or the small farms are shipped to the large plants. The freight charges, which are very burdensome, are always paid by the farmers. In some sections all dairy cows are required to be tuberculin tested, and with heavy rents and taxes, occasional droughts, lack of suitable

labor, and with cow-testing associations and cooperative organizations just beginning, it is not difficult to see why dairying has not developed more rapidly.

PRODUCTS—Butter and cheese are the leading products although casein is produced in large quantities and condensed milk is manufactured to some extent. The largest factories, such as La Martona and Granja Blanca, have a capacity of 5 tons of butter per day, besides other products and the retailing of milk and cream to the largest cities. Four of the largest factories are located in Buenos Aires and are said to produce about 60 per cent of all the butter made in the country.

The kinds of cheese follow the lines of greatest possibility for market, hence are imitations of well-known varieties: Cheddar, Gruyere, Edam, Romano, Roquefort, and Emmenthal, while the other varieties are: Shrinz, Reggiano, Goya, Pategras, Fontina, Chester, Chubut, Tofi, Tambo, and Quesitos. The native varieties of cheese are made for local consumption. Sheep-milk cheese is made in one factory.

MARKET MILK—The following statement is from Mr. M. Douglas and relates to market milk:

"The development of the fresh-milk supply in Buenos Aires, Rosario, Cordoba, and other towns has been rapid. It is now appreciated that hygienic conditions must be observed in the handling of milk and in the city of Buenos Aires pasteurization is compulsory. The population of the city is 1,500,000 and the milk supply imported. It is only 20 years since the first creamery and tea shop was started by an Englishman in the city and the consumption has risen since then to 440,000 quarts daily. The small farmers and peasants from the Basque country of Spain, whose traditions are all in connection with pastoral pursuits, form a large part of the rural population in the country and they deliver the milk from their small farms to the large companies, who then pasteurize and distribute it."

CHRONOLOGICAL EVENTS

YEAR

- 1497 Columbus discovered the mainland of South America.
- 1516 The La Plata River discovered by Juan Diaz de Solia.
- 1532 Spaniards brought European cattle to the country.
- 1553 Cipriano and Vincent Goes brought 7 cows and 1 bull to Argentina from Brazil.
- 1570 Don Juan Ortiz de Zarate imported cattle, including 4,000 cows (arriving at Asuncion).
- 1600 Cattle had spread over the plains.
- 1602 The Royal Cedula of Philip III granted exports of "Dried and salted beef and tallow."
- 1607 Fifty hides were exported.
- 1783 Estimated that 500,000 head of cattle were slaughtered annually.
- 1810-73 Countries declared their independence — revolutions during the whole period.
- 1848 First purebred Shorthorn bull imported by John Miller, "Tarquin."
- 1866 Argentine Rural Society founded for development of livestock.
- 1870-81 Imports of cattle very small—only 4,000 head.
- 1875 Royal Society, annual cattle shows begun—continuing to date.
- 1877 Meat exportation began.
- 1889 Infant mortality 19.3 per cent of population.
- 1898 Ministry of agriculture established.
- 1901 Law passed requiring tuberculin test for cows furnishing milk for Buenos Aires.
- 1906-8 Inspection of farms showed 18 per cent of animals infected with tuberculosis in Buenos Aires.
- 1907 Buenos Aires required all milk for consumption to be pasteurized.
- 1911 Office of Dairy Industry and Refrigeration established.
- 1909 Partial drought.
- 1909 Irrigation law passed.
- 1910 Herd books of dairy breeds established.
- 1914 World War; demand for food, especially dairy products gave great impetus to dairying.
- 1915 National inspection of dairy products to prevent adulteration established.
- 1915 Five societies united for more economical control of dairy products manufacture.
- 1921-22 Drought in province of Santa Fe.

NUMBER OF DAIRY COWS AND TOTAL CATTLE
(Comision del Censo Agropecuario, Estadistica
Agricola, and Argentine Year Book)

Year	Dairy Cows	Total Cattle	Year	Dairy Cows	Total Cattle
1888	.....	21,963,930	1917	2,349,000	27,052,000
1895	1,800,799	21,701,526	1918	2,378,000	27,392,000
1908	2,163,900	29,116,625	1920	2,431,000	.....
1914	2,246,000	25,866,763	1921	3,294,987	.....
1915	2,291,000	26,387,000	1922	.....	37,065,000
1916	2,319,000	26,717,000	1924	.....	.....

PRODUCTION AND CONSUMPTION OF BUTTER AND CHEESE
(Estadistica Agricola)

Year	Butter		Cheese	
	Production	Consumption Per Person	Production	Consumption Per Person
	Thousand Pounds	Pounds	Thousand Pounds	Pounds
1903	19,478	1.53	2,619	1.01
1905	19,475	1.35	4,300	1.51
1910	16,617	1.53	6,045	2.17
1915	22,368	1.47	14,938	2.68
1920	63,206	1.91	55,580	5.07
1921	72,295	1.85	52,265	4.57
1922	73,616	2.43	47,511	3.80
1923	90,273	2.61	47,258	4.07
1924	86,117	2.05	38,158	4.03

IMPORTS AND EXPORTS OF BUTTER, CHEESE AND CONDENSED MILK
(Argentine Year Book, Egtadistica Agricola)
Thousand Pounds—000 Omitted)

Year	Butter		Cheese		Condensed Milk	
	Imports	Exports	Imports	Exports	Imports	Exports
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
1870	103	.....	1,263	.....	.....	.....
1880	241	9	1,252	3	.....	.....
1890	.....	.....	2,621	.....	.....	.....
1900	.....	.....	3,029	2	.....	.....
1910	1	6,342	9,356	1	.....	.....
1920	9	47,368	625	13,575	.....	366
1924	3	65,437	2,546	3,461	1,016 ¹	156 ¹
1925	...	57,306	.....	414	.....	.....

¹ For 1923.

EXPORTS OF CASEIN
(Argentine Year Book)
(Thousand Pounds—000 Omitted)

Year	Exports	Year	Exports
	Pounds		Pounds
1911	4,758	1922	22,123
1915	5,750	1923	24,976
1920	19,533	1924	31,967
1921	18,664	1925	36,596

BOLIVIA—Bolivia has an area of 703,400 square miles, or 450,176,000 acres. Practically the whole of this country is very high and, therefore, is not specially suited to dairying. It is divided into five climatic elevations, or regions: 1. Puna Brava—the region between 13,000 feet above sea level and the snow line. 2. The Puna—the region between 11,000 and 13,000 feet. 3. Cabacera de Valle—9,000 to 11,000 feet. 4. Valle or Media Yunga—6,000 to 9,000 feet, including the fruit region with many tropical fruits, and 5. Yunga—tropical climate.

There are vast pasture lands in the southeastern part of the country where many wild cattle exist.

Difficult access to markets is possibly the greatest drawback of this country, and that is especially discouraging to dairying.

The inhabitants are composed of whites, of Spanish descent, Indians, and negroes. The negroes are few, but there is a great number of people of mixed blood.

EARLY RECORDS—Bolivia belonged to the old Kingdom of the Incas of Cuzco (1018-1524), which had a high degree of civilization. The country was conquered in 1538 by the Spaniards but Spanish rule was not established until 1570. In 1809-24 the country revolted and gained its independence in 1825. From that date until about 1880 there were continuous wars, either internal or with neighboring countries.

The number of cattle in Bolivia in 1910 was 734,266, which is a very small number for so large a country. The principal dairy activities are in the importations of dairy products but even they are small.

BRAZIL

NATURAL CONDITIONS—The area of Brazil is 3,276,358 square miles, or 2,096,869,120 acres being just a little smaller than the United States of America. It is naturally divided into three regions: 1. The low, coastal region. 2. The table land, 2,000 to 2,500 feet above sea level. 3. Large plains watered by the Amazon River.

The large plains south of the Amazon River are of most interest. They are covered with grass and cattle and stretch away for hundreds and hundreds of miles. The cattle are mostly semi-

wild and of varied description. As early as 1891 it was said that there were 17,000,000 head of cattle, but in 1922 there were 28,962,180 cattle and about 7 million goats.

CLIMATE—In so extensive a region as Brazil the climate and soil must vary greatly in the different localities. The variations in climate are not so great as may be expected, as the country lies mostly in the Torrid Zone, on both sides of the equator. In all Brazil December, January, and February are the hottest months and June, July, and August, the coolest. Where the elevation is 1,200 to 1,400 feet, as in Minas and Sao Paulo, there is no need for barns at any time of the year. Rainfall is generally very plentiful.

The natural fertility of the soil is surpassed by few countries if any but possibly not more than one-one hundredth of the soil is under cultivation.

The population is composed of whites, (52 per cent), Indians (savage, 13 per cent), and blacks (9 per cent), ex-slaves. The Indians predominate in the North and the negroes in the South. There are also many people of the mixture of these races, about 26 per cent). The early settlers were Portuguese, but German, Italians, and Spaniards now form a large part of the white race.

EARLY HISTORY—Brazil was discovered May 3, 1500, by Vicente Yanez Pinzon, a companion of Columbus. In 1730 diamonds were discovered. In 1820 Brazil revolted and in 1825 became independent. The slaves were emancipated, beginning in 1866 and gradually released until 1871.

Some of the hindrances to cattle raising or dairy development are: That most of the cattle are of low beef grades and that cattle diseases, even when not fatal, prevent the cattle from reaching a slaughtering condition. There is no system of marketing, and facilities for slaughtering and means of transportation, both domestic and on the ocean, are far short of the needs of the country in its present development and there is little encouragement for the future.

DEVELOPMENT OF DAIRYING—The progress and present state of dairying in Brazil is given by Mr. L. Merchant, of the Pan American Union, after living in that country for several years. His "Memorandum of the Industry" is in part as follows:

"The production of milk and its derivatives is carried on almost everywhere in Brazil. There is hardly a farmer, however modest his pretensions, who can not boast of at least a cow or two, and there are many who own enough to supply all the milk, butter, and cheese required for home use, while in the neighborhood of towns and cities there is always a more or less abundant supply of these commodities from the surrounding country.

"In some parts of the country where cattle are raised in considerable numbers, but which do not possess facilities for marketing of milk and butter, the milk is utilized to make a peculiar type of cheese. This cheese, which is usually made into the shape of a gourd or cushaw, has a particularly thick and hard rind and is calculated to keep for a considerable length of time. It is sold under the name of "queso do norte," or northern cheese.

In the State of Rio Grande del Sul there is a kind of cheese produced on exactly the opposite type, being very soft and therefore incapable of keeping for a long time * * * Another sort of cheese is made in the neighborhood of Petropolis, in the State of Rio de Janeiro. * * * A salt cheese of the Camembert variety is also made in that section. These two cheeses are made in regularly established factories, but the fresh sort is made by the farmers, also. These people make a considerable quantity of butter which is consumed in the city of Rio de Janeiro. * * * Dairy work has been organized on broad industrial lines in the States of Sao Paulo, Rio de Janeiro, and Minas Geraes. The last-mentioned state is famous for a particular type of salt cheese, which is consumed almost entirely in Brazil. In shape it resembles a grindstone without the hole and is usually 8 to 10 inches in diameter and 3 or 4 inches thick. The mass of cheese is white and contains numerous cavities (similar to the Swiss). * * * This type, 'Mineiro,' is the one commonly adopted in the making of cheese by small farmers. * * * Throughout all Brazil it is looked upon with great esteem. * * *

"A number of factories have been established to produce what is called English-Dutch cheese and is known in Brazil as Rhine cheese. It is a yellow cheese of spherical shape, colored red on the outside, and closely resembles the genuine Dutch cheese. * * *

"Butter is manufactured in Minas Geraes in large quantities. It is put up in both tins and kegs. An important feature of the Minas dairy activities is the shipping of milk to Rio de Janeiro and other large cities. In the city dairies, called in Portuguese 'laiteries,' milk is served icy-cold, warm, or hot, according to the taste of the customer; also they serve clabber formed in the bowls in which served.

"The State of Minas Geraes is considered the most important dairy State, but the States of Rio de Janeiro and Sao Paulo are now producing large quantities of dairy products. It is estimated that about 106,000 quarts of milk are consumed daily in Rio de Janeiro." (1918.)

Brazil is without the advantages of refrigeration and, therefore, like all the warm countries, the purchase of each day's supply of milk is made and the milk is at once boiled to make it keep. The farmers deliver the milk to the cities in large cans similar to

the 10-gallon cans used in the United States and England. Very little milk is used in cooking and prior to 1905 the only butter available on the market was canned.

The production of dairy products does not meet the needs of the population. Possibly the State of Minas is the only one that produces more than it consumes. The industry continues to improve, owing to the erection of large cold-storage plants and the introduction of Swiss, English, and Dutch breeds of cattle.

The present dairy breeds of cattle in Brazil, are shown by the entries in the Third National Cattle Exhibition, opened July 4, 1920. In the milk-cow division there were shown a number of breeds of which the following are a part: Zebu 294, Caracu, 14, Hereford, 301, Polled Angus, 20, North Devon, 16, Normandy, 15, Flemish, 13, Dutch, 108, Guernsey, 20, Jersey, 30, local breeds, 12, Red Lincoln, 5, cows of various breeds, 7.

There are also many Brown Swiss, Simmenthal, Limousine, and Friesian cows with a multitude of crosses.

The immunization of cattle from diseases is now receiving great consideration.

CHILE

NATURAL CONDITIONS—Chile is a long, narrow country lying entirely on the western side of the Andes Mountains. It is about 1,200 miles long and from 90 to 130 miles wide. The surface is mountainous and the mean elevation of the mountains is 14,000 feet. The area is 292,414 square miles of which 52 per cent is capable of cultivation, 23 per cent is in forests. 13 per cent is waste land, 5 per cent is in irrigated and 7 per cent is in pastures.

Chile is traversed by lateral ridges separated by deep valleys, some of which are in the central and southern parts. The country north of Valparaiso is mostly arid and sterile. Bituminous coal is found in abundance.

The climate of this region is rather healthful. Rain falls only between June and September, but the northern deserts are subject to droughts which continue for years. The hottest months of the year are January and February, when the mercury sometimes rises to 95° F. in the shade.

The middle portion of the country is adapted to grazing and the cultivation of grains.

A large portion (about 40 per cent) of the population is of Spanish descent and the remaining portion is mixed races and Indians.

EARLY HISTORY—Chile was a part of the Dominion of Peru and was conquered in 1535 by the Spaniards. In 1810 the Chileans revolted against Spain and obtained its independence in 1818. It appears that Chile had a free and stable government much earlier than the other South American countries.

CATTLE—The principal breeds of dairy cattle in Chile are the Friesian and the Jersey. There are some very fine herds of Friesian cattle, purebred, and with excellent records for milk production. This breed is the most numerous of the dairy breeds although the Jersey are also very important. The number of milk cows in 1922 was 202,151. While this is not an increase in numbers over the 1909 figures, still the yield of these cows was much larger, as the total production of milk in 1909 was 281,-444,000 pounds and in 1922 it was 371,163,000 pounds.

DEVELOPMENT—Although for years the dairy industry had been neglected it has in recent years received much more consideration and rapid progress is being made in all lines—breeding, manufacture of dairy products and in the promotion of fairs, shows, etc.

The imports of all dairy products was the greatest from 1905 to 1915, but the production of condensed milk has caused a decrease from 1,351,000 in 1913 to 280,000 in 1922. The cheese imports have also decreased to about one-fourth of the 1912 figure which was less than one million. The exports of dairy products of any kind are very small as the products are needed for the domestic consumption.

COLOMBIA—The area of Colombia is 443,378 square miles. Much of this territory is in the highlands of the Andes Mountains and therefore not well suited to agriculture or to dairy farming, but the country has two fine valleys, the Magdalena and the Cuzco, and there is a vast extent of plains east of the Andes, which is drained by the Orinoco River. The climate in the valleys

and in the plains is well suited to dairying. The plains are covered with native grass, Para and Guinea grass, and at present are supporting about 8,000,000 head of half-wild cattle.

Colombia was first colonized by Spain in 1510 and called "New Granada." It remained under the Spanish rule until 1811 when it revolted with success.

The first cattle were brought to the country from Andalusia by Alonzo Ruiz de Lungo in 1570. They numbered 36 head and all the cattle of the country are from that origin.

Dairying is still practically all with the farms and only one or two creameries exist in the whole republic. The factories are very small.

ECUADOR—The area of Ecuador is 118,627 square miles. The country consists of great variation of surface and climate, elevated plateaus and lowlands. The latter regions have a very hot climate. The plains east of the Andes are called "llanos" and are well watered and covered with good grass suitable for stock raising. In the high tablelands of Quito (elevation 9,543 feet) the climate is like perpetual spring. The winters differ from the summers only by greater rainfall. Wild horses and cattle cover the plains.

The population is composed of white people of Spanish descent, and civilized and uncivilized Indians.

CATTLE—The early history of cattle in Ecuador is connected with that of Colombia, Peru, and Bolivia, as these countries were at one time under a single government. Just when the first cattle were brought into the country is uncertain but their numbers increased until the plains now have many cattle, a total of about 2,000,000 head.

Since the year 1906 there has been a considerable increase in the effort to develop the native cattle and to breed purebred dairy stock. The account of the importation is as follows as given by the Farm and Dairy:

"A breeder of Holsteins sent an account of the first importations into Ecuador by his father, who imported in 1906 two bulls and one cow, and there being no railroad further than Mocha, these cattle had to be provided with shoes and traveled by easy stages. The cow arrived sick and had to be transported in a wagon, but finally reached the farm, Los Potreros. One of the bulls died and the cow broke her leg, but it was well mended and in spite of all hardships she

managed to rear three sons. One was a bull, 'Ideal,' awarded the gold medal at the Exposition of 1909. Further importations were made in 1908, 1909, 1910, 1911, and 1912. * * * He had laid the foundation of the first Holstein herd in Ecuador and left to his widow and sons a splendid business. Today they are milking 150 cows (1922)."

GUIANA (British, Dutch, and French)—Guiana is composed of three provinces which from west to east belong to Great Britain, The Netherlands, and France. It has a low coast line which is from 10 to 40 miles wide and is all but covered at high tide. Next comes a low range of hills leading to a wild range of mountains at the southern border of the country.

The climate is not hot and moist, as the mean temperature is only 81° F. There are two wet seasons in British Guiana and Dutch Guiana, but only one wet season in the French province.

The areas of the provinces are as follows: British—76,000 square miles, Dutch, 45,000 square miles, and French, 18,000 square miles.

The population consists of whites, Indians, negroes, Chinese, East India coolies, and many mixtures of those races.

CATTLE—While cattle have been used for all purposes, dairying has received little attention. The number of cattle in 1914 was given as 89,500 head in British, 8,000 in Dutch, and 400,000 head in French Guiana.

The imports of all dairy products are comparatively large and the volume has not varied much in recent years, indicating that dairying is not supplying the needs of the people.

The board of agriculture in British Guiana has introduced pedigreed stock, including Shorthorn, half-breed Guernsey bulls, Holstein cows, and Zebu cows.

PARAGUAY—The area of Paraguay is 196,000 square miles (125,440,000 acres). The climate is subtropical with periods of excessive heat and heavy rainfall. The mean temperature in summer is 81° F. and the mean temperature in winter is 71° F. There are the usual tropical pests, including the cattle tick, while the cattle are seriously affected by the foot-and-mouth disease.

Transportation facilities are in a primitive stage. The soil is very fertile and the pasture lands are of the best in South America. The native grasses are good, especially the jaragua which was brought from Brazil.

CATTLE—Cattle breeding has been an industry ever since 1550, increasing rapidly owing to the fine pasture lands. For the most part the cattle are of the criolo type, native, of indiscriminate colors and with long horns. A few companies are trying to raise the standard of the livestock. Some Hereford bulls from Argentina have been imported and a few years ago experiments were made with the Zebu from Brazil, but the attempts were abandoned. Up to the year 1920 little progress in constructive breeding had been accomplished. The number of cattle in Paraguay in 1921 was 5,000,000.

The governmental encouragement for pastoral colonies is peculiar and is in brief as follows:

"The public lands not occupied by colonies and by Indians may be let for stock breeding, on condition that the letting agreement may be canceled whenever the Government deems it opportune to set aside the lands for purposes of colonization or to place them at the disposal of the public administration. In such cases, the tenant must give up the land within six months and will have no right to compensation.

"The settler cannot sell, mortgage, renounce or transfer in any manner whatever, except to his legitimate heirs at his decease, the provincial title or right of possession of lands to which the law relates. * * * Land is not subject to seizure for debt. In case of separation of husband and wife it remains the property of the one on whom the maintenance of the children falls." (Inter. Rev. of Agric. Econ., June-July, 1921.)

DEVELOPMENT—Milk used for food in Paraguay is almost exclusively cows' milk, goats' milk being almost unknown. Nearly all this milk is from the native cows and the yield is about $3\frac{1}{2}$ quarts a day. The dairy business, with the exception of Asuncion, the capital, is still in a very primitive condition. The consumers in many villages are supplied by small producers on farms. Up to 1915 deliveries of milk were made in jars on donkeys or on the heads of women carrying a varied assortment of tin and glass receptacles. A modern dairy has been established in Asuncion. This dairy buys all the milk possible in Paraguay and imports some from the Argentine; however, the daily consumption is only about 6,000 quarts. Milk is used mostly for drinking. Very little is used in cooking or for the manufacture of butter and cheese. The imports consist of cheese, butter, and condensed milk.

The number of cattle in Paraguay is no indication of the dairy industry but it does indicate the possibilities if the country should turn to dairying.

PERU—The altitude of Peru is its special peculiarity but there are many fine regions of grass lands where livestock are pastured in large numbers. The climate is severe but during the summer months it is very pleasant. There is much waste land and the mountainous regions cover a large portion of the country and are not suited to either agriculture or grazing. The area is 695,733 square miles.

The estimated number of cattle in Peru is given as 3,000,000. During the period since 1922 serious efforts have been made to improve the livestock of the country.

EARLY HISTORY—One of the earliest books written on the conditions of Peru is entitled "Royal Commentaries of Peru," by Garcilasso de la Vega (son of one of the last of the Incas and a Spanish nobleman). The work was written in the middle of the 16th century and was translated into English by order of King James. The following are quotations:

"Before the time of the Spaniards came into Peru, the Indians had no other distinction or variety of tame cattle, but only of the Paco and Huanacu. * * * The Indians made use of the wool of the Huanacu for clothing. * * * The vicuna is longer legged than the biggest goat. Its wool—a light chestnut or lion color (wool used by the royal family only).

"It is believed that cows were brought into Peru presently after the conquest which soon increased and multiplied in those numbers that they supplied the whole kingdom." * * *

The next quotation is possibly the earliest tale of an ox team in America.

"The first oxen I saw at plough were in the valley of Cozco, about the year 1550, belonging to John Rodriguez de Villalobos; there were only three of them. I was carried to see the sight with a great number of Indians who flocked from all points with astonishment and wonder, to see this prodigious novelty. * * * They said the Spaniards were drones and would not work, themselves, had made these great animals labor and do the work which they ought to have performed themselves. I have reason to remember for when I was a boy and played the truant to see oxen plough it cost me two dozen of good stripes, one-half of which I received from my father and the other dozen from the school master.

"The price of cows was 200 pieces of eight¹, later in 1554 it was 100 pieces of eight; in 1559 I have seen them sold for 17 pieces of eight.

¹ The value of pieces of eight was about 1 peso (96.5 cents).

"The cows of Barlovento running into the mountains became also wild, except only such cows as they kept in their inclosures for the convenience and benefit of milk, butter, and cheese, which they made of them; but such as run wild in the mountains, multiplied and increased to such a number, as would be incredible, did not the hides of them, which are yearly brought thence to Spain, give us clear and demonstrative proof thereof, as Acosta verifies in 33d chapter of his fourth book, whence he reports. 'That in the year 1587 there was then brought in from St. Domingo, only 35,440 hides, and in the same year from New Spain 64,350 cow hides, which in all is 99,794'."

MODERN TIMES—In 1918 a special consular report gave the conditions in which dairying is trying to develop and it is not a great deal above the 16th century dairying. The principal occupation of the country people around Arequipa is the cultivation of forage and grains, the sale of which scarcely covers the necessities of the people and feed for the cows. Some of the farmers have contracts to furnish milk to a small creamery where a little butter is made for the better class of society. The remainder of the people are provided with butter made by hand in the country. In the highlands also a small quantity is made.

The industry is in a rudimentary stage but there are no substitutes for dairy products. The creamery mentioned is run by an American connected with the Harvard Observatory at that place.

Another consular report, dated June, 1925, stated that 500,000 pounds of butter were manufactured and the Indians make a cheese which is delivered in Lima and other cities—a total of about 300,000 pounds. This cheese is made from 90 per cent cows' milk and 10 per cent goats' milk, and is eaten fresh. There is a growing demand for the products prepared by the Indians but there is also an important importation of both butter and cheese.

In 1926 there were 2 modern dairies established in Lima, which sell pasteurized milk.

URUGUAY—This is one of the smaller countries of South America and has an area of only 72,153 square miles. The climate is subtropical, being warm enough to make the use of barns unnecessary any time of the year. The pastures are green the year round and cattle can be grazed continuously without additional feed.

The history of dairying in Uruguay is really a leading up to the subject by a discussion of the development of cattle and the

present improvements of native breeds, and simply touching on the present tendency toward dairying, especially around Montevideo.

CATTLE—Up to the year 1600 there were no cattle in Uruguay. The natives had no cattle and lived on hunting, fishing, and wild fruits. In 1603 Governor Hernandaria de Saayedra caused several hundred cattle to be imported from Argentina. These cattle were given the most favorable pastures and multiplied very rapidly. When they had adapted themselves to the country they became the native wild cattle (*criollo*).

In 1624 there was a colony settled on the coast to hunt wild cattle. Beef was of no value and the hides were worth only 80 cents each. Thus the 150 years of "hide period" was started. Montevideo was founded by a colony of Portuguese and settlers were granted 18 acres for farm land and about 5,000 acres for ranches. In 1670 a decree forbade the butchering of cattle for meat and allowed only the bulls, oxen 5 years old, and male calves to be slaughtered. This caused a rapid increase in cattle. In 1754 the first "saladero" for salting and drying beef was started but with little success. In 1786 a large saladero for handling all products began operation and was able to handle 1,000 cattle a day. Cattle brought only 30 cents a head. This was the beginning of the "meat period," and following there were civil wars and all progress ceased.

In 1860 the improvement of the *criollo* began with the introduction of Shorthorn bulls. In 1864 the Herefords were introduced, the Devons and Polled Angus in 1874, Ayrshires, Simmenthal, and Jerseys in 1887, Dutch (Friesian) and Red Flemish in 1910, and Black Spotted Flemish in 1912.

The first herdbook was established in 1887 and by 1913 had registered many thousands of purebred cattle of which 310 were of the dairy breeds.

Formerly all animals roamed freely on the pastures and the herdsmen rounded up the cattle when required. Later, the properties began to be surrounded by wire fences. Fencing laws were passed in 1875, and after that date the pastures were subdivided especially to divide breeds. The improvement led to greater care

for the cattle. In 1877 the State gave assistance and encouragement to fairs and shows which at present are organized over all Uruguay.

MARKETS—The 150 years of "hide period" gave way in 1780 to the salt-meat industry and the exportations were principally to Cuba and Porto Rico. This industry increased the price of cattle about 5 fold. In 1885 Liebig's Extract of Meat Company erected a large factory and other industries arose. The cold-storage industry is of great importance. Brazil is taking the jerked-beef industry from Uruguay. Thus the meat industry of Uruguay is meeting definite competition from Brazil and Uruguay is turning to dairying, although slowly. A model dairy is annexed to the agricultural school for teaching dairying. The school is at Estanzeula, Department of Colonia, and has an excellent herd of milk cows and all the necessary machinery for proper dairy work.

Milk is produced on farms of varying sizes, either as a part of the ordinary farm routine with dairy cattle, or by more specialized methods, particularly farms near the cities. There are a large number of purebred dairy cattle and many crossings which are used for dairy purposes.

In 1914-15 the Government made a survey to ascertain the consumption of dairy products in the chief towns. The average daily milk consumption of Montevideo was estimated for that year at 228,874 pints, which was sold by 172 dairies, 105 milk shops, and 733 milk distributors. The consumption of milk per person was, for 18 departments, 0.2 to 0.4 pint a day, while the highest was 1.18 pints.

BUTTER AND CHEESE — For the present this branch is limited to the domestic needs. Besides the establishments which specialize in butter and cheese there are the mixed farms where milk cows are kept. These farms make a limited quantity of butter and cheese, partly for home use and partly for sale. In the Department of Colonia the milk industry is more extensively developed on account of the Swiss settlers who have established creameries. The more important cheesemaking sections are in Maldonado, Colonia, Tuscumrembo, and Rocha. Montevideo is the principal market for all kinds of dairy products. The total production of butter and cheese is not of record.

The importations of dairy products are not large and are decreasing. Cheese forms the largest import and is used in various ways.

Within recent years there have been many laws and regulations for the control of the production and care of dairy products and the handling of cattle.

Cooperative societies so far have not played an important part in milk production or the marketing of milk products in Uruguay; only one society has been founded which is acting as an experiment in this direction. Cooperation is just beginning but is being favorably received.

VENEZUELA—Venezuela contains 393,976 square miles, more than half of which is covered with a rich forest growth; of the remainder, more than 120,000 square miles consist of rich prairies ideally adapted to the cattle-raising industry. It is well watered, covered with nutritious grasses, and possesses a river system with excellent means of navigation. The Pan American monthly bulletin, 1920, gives the following glowing description of the country:

"The greatest prosperity that seems inevitable for Venezuela will be closely connected with the livestock industry. It is doubtful if in any place in the world there exists such an ideal and almost limitless area for the breeding of livestock, particularly beef. Starting in the rich delta of the Orinoco an immense sea of grass of the most nutritious character stretches for hundreds of miles on every side. Although it is now estimated that there are 2,600,000 head of horned cattle in the country, there is ample pasturage for a hundred times that number. The average climate of the grassy sections of Venezuela is, of course, a great deal warmer than in the cattle sections of the United States, but careful experiments in breeding and acclimating the northern breeds have proved that it is perfectly feasible to breed a high type of beef cattle in warm countries."

CATTLE—At the present time the cattle run wild generally and little effort is made to improve the grade of stock; those who are in the business simply devote their time to rounding up the cattle and selling them for what they will bring, much the same as was done on the western plains of the United States about 50 years ago.

While the estimate of the number of cattle is much discredited it seems fair to state that there must be at least 3,000,000 head of cattle in Venezuela. Part of these cattle are dairy breeds, such as

Friesian, which are used exclusively for dairy purposes. As far back as 1848 the exports of cattle numbered 15,832 head annually.

The original cattle were imported by the Spaniards soon after the discovery of the main land of South America, and as early as 1804 the cattle numbered 1,200,000 head.

DAIRY DEVELOPMENT—The manufacture of dairy products does not entirely depend on the cows in Venezuela, as there are an immense number of goats which are used for milk as well as for meat. The production and consumption of dairy products for the first 300 years was a matter of family needs being supplied by the family cows.

In the 19th century the figures were practically all on the side of importations and as United States Consul Brett says:

"It was always considered regrettable that a nation of less than three million inhabitants where there are very probably more cows than people should be such a heavy importer of butter and cheese. The consumption was confined almost entirely to the larger cities, as the poorer people who inhabit the smaller villages and the country, neither need nor can afford to eat imported foods."

It is supposed that the fact that these poor people "do not need" dairy products is because of the tropical fruits of that country.

In 1915 the first creamery was established by General J. V. Gomez, at Maracay. It is a complete plant and produces cheese, canned milk, and cream and hog products, as well as 1,000 pounds of butter daily. The milk is produced in the surrounding country, which has rich grass lands. The milk is said to be very rich. The butter was canned and was sold at 80 cents a pound in 1918. It was the only creamery in the country at that date.

In all the cities and towns of Venezuela milk is sold at prices varying from 10 to 15 cents a quart, a considerable portion being goats' milk. The goats were originally of the Canary island stock but are not equal to the present Canary goats as milk producers. Because of the steepness and narrowness of the streets the milk is delivered on horseback, but it is not unusual for cows to be led from door to door and milked in the presence of the customer. The average purchase is about one-half pint of milk. On these door-to-door trips the calf accompanies the cow and is tied to one

of the cow's legs while the cow is being milked. It is not considered safe to use milk except either while still warm from the cow or after it has been boiled.

Queso llanera, or cheese of the plains, is a staple product. It is a white, porous, and very crumbly cheese, though of course the quality varies. Much of this cheese is produced from goats' milk, and sometimes it is said to be very bad. The Maracay creamery is now making yellow (Cheddar) cheese in quantity.

It is estimated that 15,000 cows are milked in the entire country, but the number of goats is beyond the possibility of even an estimate.

TRADE—The exports of Venezuela are of no importance and amount to but a few thousand pounds of cheese and a few hundred pounds of butter. The imports of dairy products have been large for years. In 1915, the butter imported was 568,762 pounds, and of cheese there were imported 102,051 pounds. Of condensed milk 23,911 pounds were imported, largely from the United States.

MEXICO AND CENTRAL AMERICA

MEXICO—Mexico has an area of 767,274 square miles. Approximately 5 per cent of the total area is cultivable; other portions are suitable for grazing. Some of the latter could be cultivated if irrigated.

The population is about 70 per cent rural and 30 per cent urban. It is estimated that Indian blood and mixed races make up 90 per cent of the people.

EARLY HISTORY—Cattle were brought to Mexico soon after Cortez made his conquest of that country, although it seems certain that he had no cattle with him at the time of his conquest. It is certain that Coronado had cattle with him on his trip northward from Mexico to the present site of Kansas and it is also probable that some of these cattle were left at liberty, purposely or otherwise, by his company; these cattle soon multiplied until there were great numbers of cattle in a wild state throughout the whole southwestern part of the United States and northern Mexico. Early in the 16th century and in the 17th the wild cattle of California (then a part of Mexico) were one of the principal sources of profit for the missions, according to Alfred Robinson in his sketches of the West. Milk and dairy products were also used by these missions and some quantities were sold.

These early cattle degenerated somewhat to meet the environments of climate, altitude, and feed and eventually became the "longhorns" of the plains, more valuable for the hide than for anything else. In later years the Brown-Swiss cattle were introduced into Mexico and formed the dairy part of the livestock, but other breeds, such as the Hereford and Shorthorn, were introduced to improve the native cattle. This makes the Mexican cattle largely a mixed breed with the scrubs still in the majority but making poor beef and furnishing no dairy products worth mentioning.

DAIRYING — Strictly speaking there is little dairying in Mexico. Most of the farmers have milk cows for furnishing milk to their own families but little is sold except by those living near

villages or cities. The diet of the country is composed mostly of vegetables, such as corn, beans, and fruit; hence there is little room for high-quality dairy produce.

There seems to have been little development in the dairying as the handling of milk is still primitive in most parts of the country, although in the large ranches (*haciendas*) one will find good cows and plenty of excellent milk and butter, but cheese is a scarce article anywhere in Mexico.

The usual custom of delivering milk is peculiar, according to De Barra:

"Two cans of milk are swung across a mule's back. The driver then sits astraddle the mule and guiding the animal by striking it on the side of the neck, goes leisurely down the street shouting to announce his coming. They start out very early in the morning to supply their customers for breakfast. It is often impossible to get milk in the cities for the noon meal."

Feed is scarce and is usually very expensive although alfalfa thrives anywhere in Mexico. It is possible in some sections to raise several crops each year. Corn, however, is the principal feed but not enough is raised to supply the needs.

Probably no other country in the world is more richly furnished with natural resources than Mexico. Its formation gives it three climates within a short distance—tropical, semitropical, and temperate. From the ocean level to the tops of the snow-clad mountains is but a few hundred miles and furnishes all the climates possible with every variety of plant.

DAIRY CONDITIONS—A consular report in 1911 gives the condition of dairying at that time:

"There is no production of cheese, as the term is understood in the outside world, in the Republic of Mexico, save in a very few dairies in the vicinity of Mexico City, within a recent period; and this is only on a very limited scale. A considerable quantity of so-called cheese which in fact is only curd pressed by hand, and dries out in the shade, is made in different parts of the country where cattle and goats are raised. * * * The milk of sheep is not used anywhere in the country. Goat's milk is used extensively everywhere goats are raised. In northern Mexico, where there are large goat herds, the milk is sold in towns and is an article of staple use. * * * Zabadua cheeses are made by one firm in Chiapas and their name has been given to the brand. It is exceedingly hard and is produced in small quantities. * * * Bulls of pure blood are imported for grading up the native stock—Herefords, Shorthorns, and Holstein."

CENTRAL AMERICA—Central America is practically identical with Mexico in climate, land formation, and development, except that it is further south and, therefore, nearer the Equator. The climate in the lowlands is very warm and tropical plants are grown while back from the coast in the highlands all kinds of temperate-zone products are raised. The pasture lands in the higher grounds are well suited to cattle raising and dairying. Practically all the farms and ranches have their own milk cows and an abundance of milk and its products. The cities are supplied with milk from the surrounding country although the manner or system may be more or less primitive. Most of these countries import large quantities of dairy products and export practically none. Each country could be self-supporting if the resources of the country were turned to dairying.

The breeds of cattle are, first, the native, (Spanish types degenerated) and imported purebred dairy breeds, such as Holstein, Jersey, Milking Shorthorn, and Guernsey.

There are few dairies in Central America and such as are found generally manufacture dairy products and sell milk.

The numbers of cattle in these countries is simply an indication of the possibilities of dairying—in case all cattle were turned to high-class dairy breeds.

SAN SALVADOR—The number of cattle in this country in 1906 was 284,015. According to the Pan American Bulletin, 1910, the production of cheese for the year 1908 was more than 15 million pounds. This undoubtedly also covered all kinds of curd, cottage cheese, etc.

The imports of butter, cheese, and condensed milk, each amounted to several thousand pounds in 1906, but in 1925 the imports are negligible. A consular report of October, 1925, states that "There are no records of production of butter and cheese but enough is made for local demands, of good quality."

GUATEMALA—The dairy industry in Guatemala has been developed to some extent in recent years, but more has been done by the introduction of good dairy breeds than in the introduction of up-to-date methods of manufacturing dairy products and han-

dling market milk. The following extract from the report of Sam H. Ray, 1915, gives the conditions that prevailed at that time:

"Milk, butter and cheese are found in almost every household in the Republic of Guatemala. Most of the dairies are rather small but in Guatemala and one or two of the other cities very good establishments were found. Near Guatemala City there are 6 or 8 farms producing butter, cheese, and milk.

"The system of marketing these products is rather peculiar. The dairyman maintains a farm where feeds such as cane, corn, para grass, and guinea grass are grown. The cattle are driven from this place to the establishment in the city, which the dairyman keeps. At this place the cattle are fed grain and milked. From this point the milk is delivered either in a small cart or by mules which have large milk cans strapped on their backs.

"In one of the principal streets of the city one can see large Holstein cows tied to posts along the sidewalk. They were driven in from the farms, tied to the posts and milked night and morning and then returned to the farms.

"In one dairy the cows are tied up all the time in a well-equipped barn. The feed is brought in night and morning, cut green from the fields. Most of the dairymen have Holstein cattle and some very good ones are seen. These cattle were imported from the United States and Holland several years ago. The last shipment was received in 1906.

"Near the City of Antigua is a farm producing butter, cheese, milk, and cream, which boasts of the only silo in the country. This farm has machinery and equipment for making dairy products and the temperature is such that refrigeration is not necessary. There are no dairies on the Pacific coast."

PANAMA—Panama in 1917 had 166,937 head of cattle of all kinds. For years that country has been a large importer of dairy produce. Just prior to the World War the imports of condensed milk reached about 1 ½ million pounds and in 1916 it was over 4 million pounds. The butter and cheese imports were 600,000 and 400,000 pounds respectively, from the United States alone, while the total importation was about double those amounts.

The natural conditions of the country are suitable to dairying and already considerable attention is being directed toward that industry. A brief of an article in the Monthly Bulletin of the Pan American Union, April, 1911, gives the conditions in the principal province:

"The province of Chiriqui, lying on the Pacific side of the Continental Divide, is admirably adapted for cattle raising. The land is covered with a light forest which may be cleared with the machete. At intervals this growth gives

way to level expanses of grass-covered llanos. The prevailing herbage of the llanos is jenjebriilo, which bears a close resemblance to the famous 'bluegrass' of Kentucky.

"The region is abundently watered. Stock raising is the principal industry and there are more cattle in this province than in all the rest of the Republic's territory. There are not more than 50,000 head altogether, and there is land in the Republic that would sustain more than 5,000,000 head."

This country is now using almost all of its cattle for the production of beef and is importing most of the dairy products needed.

NICARAGUA—The number of cattle in Nicaragua in 1917 was 313,000. Here again the consul reports:

"That the production of cheese and butter is sufficient for the local demands, and the former (cheese) is exported to the neighboring Central American republics in small quantities. Cheese is an important article of food for the laboring class, and the annual production probably exceeds 5,000 tons."

(This estimate of 5,000 tons seems a little high, as it would require 100,000,000 pounds of milk to make that amount of cheese and at 2,000 pounds of milk per cow there would be needed 50,000 cows for the cheese alone.)

This country has been a heavy importer of dairy products for several years, especially from the United States. However, in 1911, the peak year of exports, it is shown to have exported 68,-415 pounds of cheese, but during the same year there was imported from the United States about 33,441 pounds.

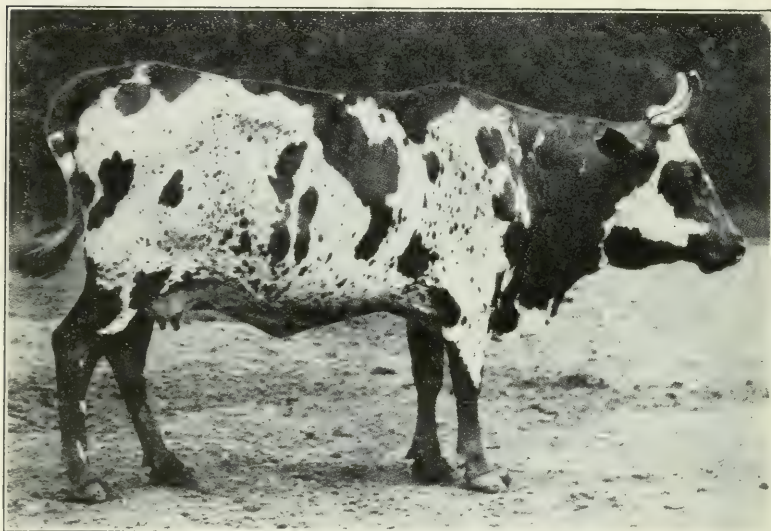
COSTA RICA—This country had in 1906, 118,502 cows and 361,045 total cattle. In 1907 there were reported 769 dairies, 218 cheese factories, and 62 creameries. The output of these factories was: 3,982 gallons of milk, 3,210 pounds of cheese, and 500 pounds of butter; hence it is evident that the factories were very small and must have been farm dairies.

There is a record of imports from the year 1883 when the butter imported was 39,134 pounds and the cheese was 35,092 pounds. In 1914 the imports were, butter, 110,724 pounds, cheese, 252,824 pounds, condensed milk, 1,020,354 pounds.

HONDURAS—The number of cattle in Honduras in 1914 was 489,200. Up to the year 1905 the country was a rather heavy exporter of live cattle, as the exports were about 40,000

head a year. The imports of dairy products consisted of about 125,000 pounds of butter and 72,000 pounds of cheese for the year 1915. The condensed milk imports for that year from the United States was 241,481 pounds—other imports not given.

BRITISH HONDURAS (Baliz)—British Honduras has about 3,000 head of cattle, all told, in the country. It is a heavy



Costa Rica Native Cow, La Lima Farm.

Courtesy of Bureau of Dairy Industry, U. S. Dept. of Agric.

importer of dairy products. In 1916 the imports from the United States alone, amounted in value to about \$75,000 and covered butter, cheese, and condensed milk. The most of the imports were condensed milk.

According to E. H. Anderson, (Milk Dealer, Oct., 1923), the cattle of British Honduras are a mixed variety with some pure-bred bulls and some grade bulls. The best milking cows average only about 2,000 pounds after the calves are fed; however, this is no guide, for the calves run with their mothers all day and are shut up at night but are allowed to take a part of the morning milk also; hence it is impossible to say what part of the milk they

get. Some of the milk is used for cheesemaking and some for household purposes. The sanitary conditions are not to be commended.

So far there are no cheese factories but a small one was in course of construction (1923). Many dairies do not use a separator but skim by hand.

"Dripped butter" is made in large quantities, as follows: the cream is skimmed and left for 24 hours, then salted, one ounce per pound of cream. It is then put into brown-cotton bags and is hung up to drip for from 3 to 7 days, when it is sold along with cheese. The cheese is "requeson" (cottage) and is ground fine and cream added before using. The cheese could not be sold without the dripped butter as the patrons require a certain amount of the butter with each 25 pounds of the cheese. The usual proportion is 6 pounds of the butter to 10 pounds of cheese.

WEST INDIES

The West Indies are situated in the Tropical Zone and produce an abundance of tropical fruit of many kinds. The completeness of such fruit as food leaves much less to be supplied in hot countries than in cold or temperate climates. The dairy industry for this reason in particular has not been developed; however, there are many millions of cattle in these islands and the production of dairy products is continually increasing. Cattle were landed in the West Indies soon after Columbus made his discoveries, but the date is not well established.

CUBA—The number of cattle in Cuba in 1923 was 5,085,031, of which the cows numbered about 2,000,000. The first records are for the year 1891, when there were 2,456,000 cattle. This is less than half the number in 1923, 32 years later. The number of cattle decreased during the period of the revolution in the 90's and the records show that in 1889 the cattle, on and off farms, were only 376,650. By 1910 they had increased to over 3 million head.

The cows of Cuba are largely mixed or scrub breeds, but there are also a number of the purebred types of dairy cattle, such as the

Jersey, Guernsey, and Holstein, besides the Shorthorn. The native cows, commonly called the Porto Rican cows, are the most numerous.

According to Consul J. S. Calvert:

"There is real dairying in Cuba (1918) and the industry is growing. * * * Camaguay, having an extensive pasturage area, is the largest cattle-raising province in the island. Natural milk is sold in all parts of Cuba, but condensed milk is in very general use and is consumed in relatively large quantities. During the year 1916, 35,276,875 pounds of condensed milk were imported, practically all from the United States. There is one condensing factory in Camaguay, owned by La Cubana Company, and it is claimed that for two years it has sent to Havana five tons of condensed milk daily."

The imports of condensed milk in 1923 were 46,299,868 pounds, of butter 2,285,312 pounds, of cheese 4,994,639 pounds.

JAMAICA (British)—There has been some excellent experiments in breeding of cattle on the special farms in the island of Jamaica, beginning about the year 1850, when Lord Howard de Walden introduced Indian cattle (Zebu) for his Shettlewood Pens. This first breed (Mysore) spread over the island. In September 1880, 5 purebred Mysore cattle were selected from the Rajah's herd and sent out to Jamaica. This breed has been excellent for improving the Criolo (Porto Rican) cows. The Mysore cows are naturally poor milkers in Jamaica. The yield is about one quart daily and it is all needed for the calf.

The HISSAR breed is quite the best in India for milking purposes, some of this breed having reached as much as 11 quarts a day. These cattle were introduced into Trinidad, whence they were distributed all over Jamaica and now form the bulk of Zebu cattle in the island. The calf crop of the Zebu is from 60 to 80 per cent of the cows. Calves run with the cows until they are about 9 or 10 months old. (See India.)

JUGARAT BREED—In 1885 four purebred Jugarat cattle were imported for Shettlewood Pens, two bulls and two cows. The crosses between this breed and the native cows, and also the Mysore breed and native cows greatly improve the stock in both size and milk yield. The Jugarat breed are good milkers and also good for draft purposes.

THE GIR BREED—In 1890 two Gir bulls were imported from India to Shettlewood Pens. This breed is generally dark brown. The Gir breed are famous milkers and rival the Nellore and Hissar breeds.

The Zebu cattle are noted for hardiness of constitution, and are good "rustlers," being able to exist on short grass and on coarse grass and shrubs usually refused by other cattle. They are also very free from many diseases especially from the cattle ticks which affect most cattle in warm climates. These cattle were imported into Jamaica on account of the similarity of climate to that of India. The Zebu thrives on highland and hot lowland, while neither excessive drought nor rainfall hurts them. They never seek the shade nor stand in water.

Honorable H. S. Gassett states:

"I find that when I had crossbred English and Criolo stock my average losses by death in a series of 13 years, before the introduction of Indian strains, was 25 per cent, up to 18 months old; in the 13 years following the introduction of the Indian bulls the loss came down to $8\frac{1}{2}$ per cent, or two-thirds less."

Hereford cattle were introduced into Jamaica in 1844. Other British possessions in the West Indies have government cattle farms to help in the improvement of the native stock and to introduce purebred stock.

In spite of the fact that Jamaica has large tracts of fine grazing land and well-developed livestock, dairying has been neglected and farm buttermaking is practically unknown. One American Fruit Company has several small creameries where butter is made and it is all sold at a good price. The island is ripe for dairying.

(Special length has been given the description of this seemingly unimportant island for the reason that the Zebu has been tried out possibly more thoroughly here than anywhere else in the Western Hemisphere and the results may be of assistance to any breeders who may plan similar tests.)

DOMINICAN REPUBLIC—Cattle raising has been one of the most promising industries of the country. The land suitable for grazing is estimated at 3 million acres. There are a few large ranches and each farmer owns a few cattle. The principal breeds are Holstein (Friesian) and Porto Rican crosses with the native

cattle. The country in general is rather free from cattle diseases and from pests. The stock run on pasture the year round. There is no real dairy industry.

HAITI—The earliest records available for this island (including Santo Domingo) shows 200,000 head of cattle in 1780. In 1800 there were 100,000 head and there appears to be no reports or estimates since that time. Haiti imports from the United States about 500,000 pounds of butter, 50,000 pounds of cheese, and 20,000 pounds of condensed milk annually.

PORTO RICO—Porto Rico has an area of 3,606 square miles and a population of 953,243, and has belonged to the United States since 1898. This island has an abundant rainfall, the soil is rich, and a large portion of it is under cultivation. The native grasses are considered good, the principal ones being Guinea grass and Para grass.

CATTLE—The cattle of the island are used for three purposes: beef, work, and milk. There were 260,000 cattle in 1899, but only 73,372 were cows. Each small farm had its cows and a few oxen. The origin of the native cattle appears uncertain. There are, besides the native breed, some Jerseys, Shorthorns, Herefords, and Brown Swiss. The Zebu has been imported from Senegal Africa and used for crossing with the native breed and it is claimed that the stock has been greatly improved by the crossing. The principal use of the cattle in previous years was for raising oxen for work on the sugar plantations.

Little care, shelter, or feed has been necessary in raising the native cattle, as they were grazed or tethered when not at work and received no extra feed the year round. The lactation period of the cows was from 5 to 7 months and the calves run with their mothers until afternoon, when they were separated, and at milking time the calves were allowed to take about one-fourth of the milk. The cows at best gave about 6 quarts a day, the milk having a fat content of from 3 to 4.25 per cent.

DEVELOPMENT—This country is still primitive in many respects and dairying is one of them. Much of the milk is delivered in old ox carts, on horseback or peddled on foot, and as there is neither cheap ice nor cold water the milk is generally boiled

to make it keep. The larger cities have more up-to-date dairies but the country is far from having a modern milk supply.

The country, like others, has its special cheeses, namely, pressed cheese and mashed cheese, but the latter does not keep well.

This island has large imports from various countries. Butter, cheese, and condensed milk are imported instead of being produced on the island.

INTERNATIONAL CHRONOLOGICAL EVENTS

Year	Country	Event
4000 B. C.	Switzerland	Cattle and dairying in Switzerland.
4000 to 2000 B. C.	France	The country contained cattle and sheep.
1st Century	France	Roquefort being made in Lozere.
400	Switzerland	Allemanni carry cattle to eastern Switzerland.
443	Switzerland	Burgundians introduce cattle into western Switzerland.
450	France	Franks enter the country and brought cattle.
400 to 1100	Italy	Butter and cheese made mostly from milk of sheep.
7th Century	France	Gerome cheese made in Vosges Mountains.
7th Century	Esthonia	Esthonians had a form of artificial refrigeration.
660	Netherlands	Cattle market in Utrecht.
768-814	France	Charlemagne established feudalism throughout his realm.
1000	Switzerland	Ground cheese (Schabziger) made in Glaris.
1066	France	Norman conquest of England, cattle introduced.
1100	Italy	Cows began to take the place of sheep.
1107-37	France	Louis VI abolished serfdom.
1288	France	Gruyere cheese being made in Doubs.
1200	Italy	Grana and Gorgonzola cheese made in Po Valley.
12-1300	Norway	Norway had an export trade in butter.
13-1400	Switzerland	Cheese production was prominent but exports prohibited.
1365	Netherlands	Butter and cheese market in Gouda.
13-1400	Sweden	Sweden had an export trade in butter.
1380	Balkans	First cooperative cheese factory located at Voralberg.
15th Cent.	Switzerland	"Emmenthalerkase" made and exported.
14-1500	Esthonia	Esthonian peasants became serfs under Sweden.
1500	Italy	Expansion of cheesemaking in England, France, Germany and the Netherlands caused Italy to lose its domination in dairying, and dairying was neglected until 1800.
15-1800	Balkans	Turkish dominion, farmers lost all rights to land.
1622	Switzerland	Emmenthal cheese made "fat," "half-fat" and "poor."
16-1700	United States	Settlements made in America.
1700	Ireland	Farm butter exported.
1773	France	"Epizootic" broke out (foot-and-mouth disease).

Year	Country	Event
1700	Russia	Cholmogory cow originated by a cross of Friesian and Archangel breed in reign of Peter the Great.
1743	Sweden	English cattle imported, by Jonas Alstromer.
1733	Denmark	Peasants under feudal bondage.
1800	Switzerland	Artificial fodder introduced, stall feeding.
1800	England	Bates founded breed of Shorthorns.
1800	Belgium	Limburger cheese being made.
1820	United States	"Soiling of cattle" by Josiah Quincy.
1830-40	Denmark	Dairying begun on large estates.
1830	Switzerland	Cooperative cheesemaking begun.
1827	France	Appert made first condensed milk.
1840	England	Pleuropneumonia came from Ireland to England.
1840	Sweden	Pan method of creaming used by Tomerhjelm.
1841	United States	First milk shipped by train by Selleck.
1843	United States	Pleuropneumonia introduced from England.
1851-2	United States	First cheese factory built in New York, Jesse Williams.
1854-6	Russia	Crimean war, serfs freed.
1856	United States	Gail Borden received first patent on condensed milk.
1857	United States	Iced-cars made by W. W. Chandler.
1857	Switzerland	Dr. Chr. Muller invented the lactometer, and Marchand invented lactobutyrometer.
1860	Germany	Industries increased by civil war in United States.
1861-5	United States	Great Civil War. Dairy industry set back.
1865	Canada	First shipment of cheese to England.
1866	Switzerland	Page built first condensery at Cham.
1864	Sweden	"Cooley or Swartz" system produced.
1867-8	United States	Texas fever appeared in the northern states.
1870	Denmark	Prof. Segelcke introduced the thermometer.
1870	Italy	Demands of Franco-German war stimulate cheesemaking.
1870	Netherlands	Efforts to adulterate Dutch butter began.
1873	Denmark	Chris. Hansen began manufacturing rennet extract.
1873	United States	First silo built by Fred C. Hatch.
1874-96	England	Great agricultural depression.
1875	Switzerland	Henri Nestle invented infant food.
1874	Germany	Lefeldt exhibited centrifuge.
1876	Germany	Fleischmann annexed milk station to his school.
1878	Sweden	Dr. De Laval invented centrifugal cream separator.
1879	Netherlands	Friesian herdbook established.
1880	Netherlands	Competition from America causes greater dairying.

Year	Country	Event
1882	Denmark	First cooperative creamery established.
1883	United States	Wm. Horlick invented malted milk.
1884	United States	Square churn invented by David Curtis, Ft. Atkinson, Wis.
1884	Denmark	First bull association founded.
1885	United States	First factory established to make evaporated milk.
1886	United States	Thatcher invented glass bottles suitable for milk delivery.
1886-05	Germany	Foot-and-mouth disease prevalent.
1885	England	Milk trains into London twice daily.
1888	Switzerland	Dr. Gerber invented fat tester.
1888	United States	Dr. Caille introduced Soxhlet's sterilizer.
1889	Ireland	Sir Horace Plunkett began cooperative work.
1889	Germany	Soxhlet at Munich studying milk chemistry.
1890	United States	Dr. S. M. Babcock invented fat tester. "Babcock test."
1890	United States	Disbrow invented combined churn and butter-worker.
1892	United States	Pleuropneumonia eradicated from United States.
1895	United States	Pasteurizing machines made.
1895	Denmark	First cow-testing association formed.
1898	England	Pleuropneumonia stamped out.
1898-1900	United States	Cold curing of cheese introduced.
1899	Sweden	Ekberg invented milk drier, "Exsiccator." (Roller process)
1900	Denmark	"Lur Brand" trade-mark for butter established.
1900	Netherlands	Netherlands Dairy Products Union organized. (F. N. Z.)
1901	United States	Milk first made by spray process.
1902	France	Gaulin invented the homogenizer.
1902	Russia	Balakshin began great cooperative movement.
1902-4	United States	Drum or roller process of drying milk invented.
1904	United States	J. L. Kraft began making processed cheese.
1904-5	Netherlands	Butter laws passed to prevent adulteration.
1905	France	Millman invented regenerative pasteurizer.
1905	United States	Sweet cream butter first made from pasteurized cream.
1905	United States	National Dairy Show organized.
1906	United States	Merrell-Gere spray process for dried milk invented.
1907	United States	Dairymen's League of New York organized.
1908	United States	First Bull Association organized—in Michigan.
1908	United States	First "Accredited herd," tuberculosis free, Maryland.
1910	United States	Feeding standards completed by Savage, Eckles, Haecker, Morrison.

Year	Country	Event
1910-11	United States	Glass-lined vats used.
1912	England	Famine prices—butter consumption fell.
1913	Russia	Great immigration to Siberia.
1914	Europe	World War.
1915-20	United States and England	Discovery of vitamins.
1917	Finland	Declared independence.
1917	Russia	Revolution, Kerensky.
1918	Russia	Counter revolution, Bolsheviki.
1918	United States	Bureau of Markets established in Dept. of Agri- culture.
1923	United States	World's Dairy Congress, Washington, D. C.
1924	United States	Bureau of Dairy Industry established in Dept. of Agric.
1924	Germany	Reconstructed finances on gold basis.

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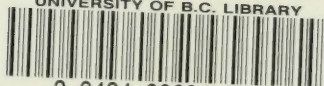
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